

# I/O News

Volume One, Number Four

**COMPUTERS IN THE PSYCHOLOGY LAB****COMMAND FILE LIBRARY****PASCAL FOR CROMIX****The OFFICIAL PUBLICATION OF THE INTERNATIONAL ASSOCIATION OF CROMEMCO USERS**

## Cromemco Introduces New Communications Software at NCC

Cromemco announced two new communications software packages at the National Computer Conference in Chicago. These packages include system software to aid the programmer in the use of the IOP and QUADART interface cards (see *I/O News*, Vol 1 No. 2) and application software designed to support phone-line communication at transmission rates from 110 to 9600 baud. With this software users can now interconnect Cromemco computers via phone lines, access timeshared computer systems, or even send text to remote typesetting facilities.

The first of these packages is called the IOP Development Software (Model IDS). The package includes a monitor ROM that can be inserted into a ROM socket on the IOP card and two diskettes containing over 300K of software. The

development software tools in the IDS package include programs to upload and download programs between a host machine and the IOP (see Figure 1.). In this way a user has access to the full sophistication of the host computer complete with Cromemco Macro Assembler or a high-level language to write his IOP software. After development the software can easily be down-loaded to the IOP RAM memory. Programs stored on disk designed to run in the IOP RAM are given the extension ".IOP". Also included in the package is a sophisticated IOP DEBUG program which allows a programmer to TRACE the execution of an IOP program, set breakpoints, display and modify register contents, and a number of other functions to speed the development of IOP software.

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## A Program to Generate KSAM Files Using Standard Data Base Schema Formats

*By Jordan Siedband*

Data Based Management Systems form the cornerstone for many commercial applications of computers. Inventories, price lists, any items indexed by some unique key are the list items eligible for a DBMS. Large main frames have had indexed file management for some time although no real standards have been imposed by ANSI with the exception of CODASYL which has not been implemented by every manufacturer.

The ISAM (Indexed Sequential Access Method) files used in CROMEMCO COBOL represent an attempt to support a DBMS within a specific language. However, a

*Continued on page 10*

## Can A Personal Computer Be Tax Deductible?

## Double Entry Bookkeeping A Genteel Sufficiency ... and Love

*By George R. Meneely*

The poet has written that all one requires is "A genteel sufficiency and love..." It is not likely that double entry bookkeeping will do much directly for your love life, but a genteel sufficiency will indeed. More literally, without that sufficiency, the most promising love may wither away in a welter of unpaid bills, consolidation loans, no money, acrimony and, soon...alimony.

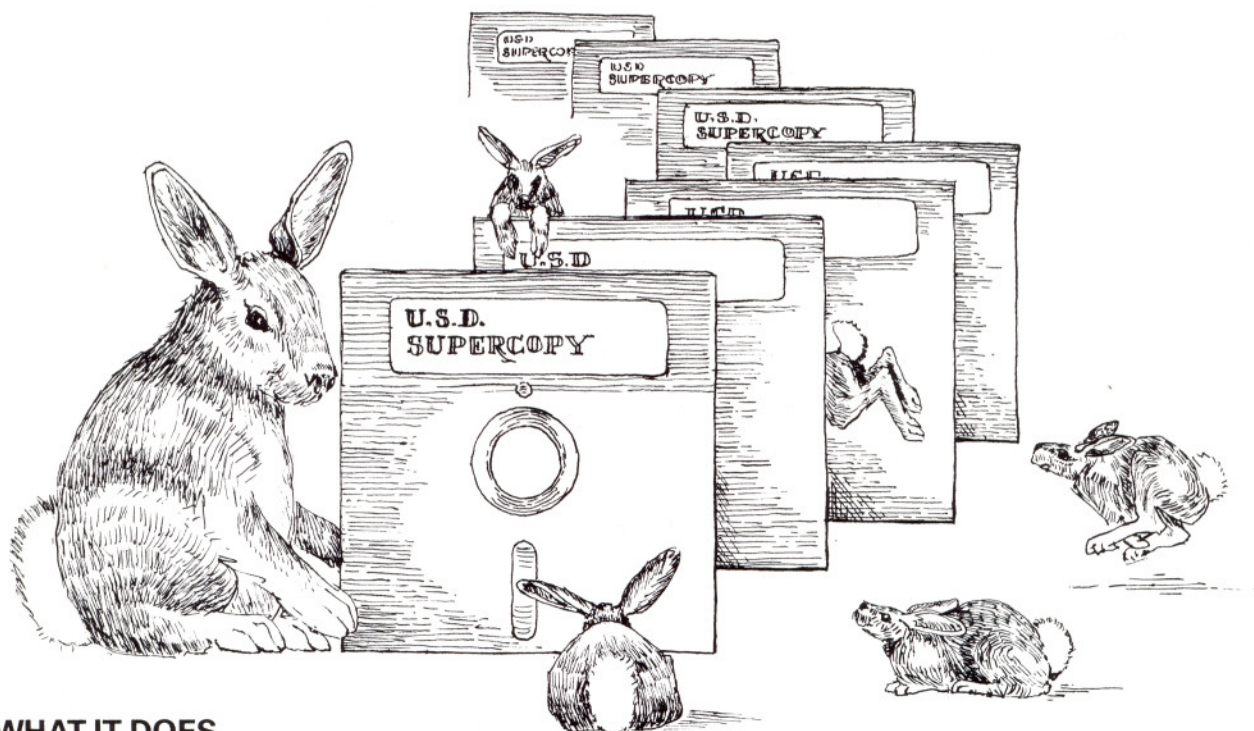
"For money has a power above  
The stars and fate, to manage  
love."

*Samuel Butler**Continued on page 11*



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## I/O News

The Official Publication of The International Association of Cromemco Users is available through membership in the association. Editorial and advertising policies are designed for the enlightenment of the members in regard to new uses for, and developments of, Cromemco products and other products compatible with Cromemco systems.

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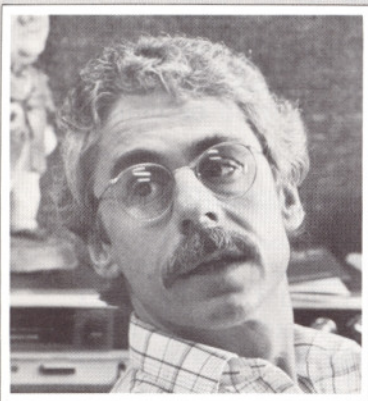
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Richard Kaye  
Editor and Publisher

Lynn Platzek  
Editorial Assistant



# output...



RICHARD KAYE



LYNN PLATZEK

## New Feature

This issue introduces a new column, **Tec Tips**. Its purpose is to answer questions of a technical nature sent by members — those questions that are not appropriately answered either by dealers, or by Cromemco's Customer Support group. The person who makes this column possible is Richard Quinn, owner of an independent computer service firm called QUINTEC. Operating from a new facility in the Agoura/Westlake area of Southern California, QUINTEC provides repair services for micros to mainframes throughout California.

Quinn is the former Director of Physical Plant and Construction for Pepperdine University in Malibu, California, and has developed special applications software for the physical plant management industry, as well as the first known microcomputer-based work order entry and preventive maintenance systems. Quinn's other areas of special interest are in computer related energy management systems, and commercial construction management.

We feel Richard Quinn is a valuable addition to our publication, and we welcome him aboard in the same spirit as he welcomes your technical questions. **Tec Tips** appears on page 6.

## What Else is New?

We get a lot of questions about new developments from Cromemco. As items are released, Cromemco gets the data to us, often in the form of an article. But, what of things that have not yet been released? In other words, what is going on behind the closed doors of Cromemco's R&D Labs?

Here are some things to look for within the next year:

### THE SYSTEM ONE

Capability: Between System 0 and System Two  
Price: Between System 0 and System Two  
Configuration: Cabinet size roughly one-half the size of a System Three  
When: Probably Autumn, 1981

### THE 16-BIT MICRO

Capability: Fast  
Price: Unknown  
Configuration: Unknown  
When: Probably Spring, 1982

### THE 40-MEG. HARD DISK

Capability: 40 megabytes of Winchester-technology hard disk  
Price: Unknown  
Configuration: Cabinet about the same as the System One  
When: Probably Spring, 1982

### TAPE BACK-UP

Capability: Provides Tape Back-up on IBM 9-track reel-to-reel  
Price: \$7995  
Configuration: PC Board plugs into C-Bus. Used with IOP/Quadart + Tape Drive unit. Model TDS  
When: 1st Quarter, 1982

### WRITEMASTER

Capability: A new, and much enhanced Word Processing package, the first in Cromemco's "Master Series" of new software  
Price: \$595  
Configuration: Available on either 5" or 8" floppy disks  
When: Probably Summer, 1981

Most, perhaps all, of the items mentioned are up and running now at Cromemco. The main reasons for delays in releasing them now are testing and ensuring their compatibility with existing components in the Cromemco lines of hardware and software.

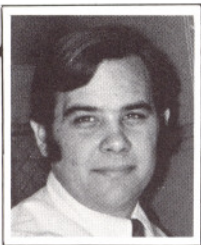
## We've Been Playing Games

For the past three issues, Analytic Associates has been advertising its Game System. Bob Feakins, owner of Analytic Associates, sent us a copy and we're hooked. If you like challenges, you'll love Super Star Trek. Trying to defeat the Klingon Cruisers before they destroy the Federation is a real test of how well the operator knows his computer — and a great way to relax. Try it. Considering all the games that come on a disk, we feel this package is a giveaway.

Richard Kaye  
Editor & Publisher

Lynn Platzek  
Editorial Assistant





TEC TIPS is a regular column aimed at providing hints for keeping systems up and running. It will not attempt to deal with specific engineering applications or non-standard configurations. TEC TIPS is edited by Richard Quinn, owner of QUINTEC, a Southern California Computer service firm.

## OLDER 4FDC's SUPPORT DOUBLE-SIDED DRIVES

Older 4FDC's can support double-sided (not to be confused with double-density) operation. This is especially useful for those planning to eventually upgrade to 16FDC. You can install the double-sided drives one at a time, and make use of more than twice the disk space until you can accomplish the complete upgrade. Newer systems shipped with 4FDC's probably have been shipped with this change, but if your's is older, or one of the kits, simply jumper J2, pin 2 to IC14, pin 7 (via J3, pin 32) for 8" drives, or Jumper J3, pin 32 to IC14, pin 7 (via J4, pin 21) for the 5" drives. This jumper allows the drive side select to be accessed through port 4 (the auxiliary disk command) and is supported by the 2.0 and newer series CDOS. After making the hardware jumper, simply gen CDOS for double-sided, single-density operations.

## QUICK CHECK FOR CRT's AND CABLE

Most CRT's use only three wires to communicate with the computer. Those are the transmit, receive, and ground lines. In its normal mode of operation, the CRT is in the full duplex mode. That is, the transmitter and receiver are separate as far as communications are concerned. Removing the BD-25 connector from the back of the computer, you will be able to see small numbers at the base of each pin in the connector. They are numbered from 1 to 25. To test the transmitter, receiver, and associated cable and connectors, simply short together pins 2 and 3 with any handy piece of metal (a small paper clip or piece of wire works fine). Then, print any printable character on the keyboard and the character should be displayed on the CRT screen. If not, something is either wrong with the CRT, or the cable. If the typed characters appear as typed, the problem is probably elsewhere. This is a good 'quick test' to help you determine if your "dead" system is caused by CRT or computer.

## 16FDC NEEDS JUMPERS FOR 20MA OPERATION

Anyone trying to use an older teletype with the 16FDC, as with the 4FDC, probably found it did not work. That is because two short jumpers must be installed to enable the 20 MA components on the 16FDC. (Cromemco may have left these circuits open to protect against im-

proper wiring of more sensitive circuits used in RS-232 terminals.) The jumper pads are located between IC15 and IC16 on the upper lefthand side of the 16FDC. To enable the 20MA receiver, jumper the pads together to the right of IC16. To the left of R21 are three sets of pads. To enable the 20MA transmitter, jumper the set closest to R21. The 20MA CRT's should then be wired to the computer following instructions in the 4FDC or 16FDC manuals. For more complete data, refer to the schematic in the back of the 16FDC manual.

## HOW DOES THAT CABLE GO AGAIN?

Ever encountered a problem installing the various ribbon cables? A simple rule of thumb is to always match the colored strip on the cable with pin 1 on the card. Pin 1 can be identified by the small triangular "tic" mark that is silkscreened on the card face next to that pin. It is often helpful to install cables before installing the card in its slot. These procedures work well with cards like the 16FDC, as its cables seem backward compared to the more familiar 4FDC cards. When you get to a complex set of cards — like the SDI Graphics System — following these procedures really can help you from becoming lost forever.

## CHECK POWER SUPPLY VOLTAGE

Have you ever experienced those on again - off again problems that defy logic? I call these things "phantoms," and I find that many of them can be traced to incorrect, unregulated supply voltages. An 8-volt supply that is too high will cause heating, and failure of card components. A supply that is too low will cause data to be lost, or improper machine cycling. For best results, check the system with all cards installed, the printer and CRT on, as well as any other peripheral devices that could affect line voltage at the unit. The taps on the 120-volt AC side of the power supply transformer should then be changed to meet the specifications of Cromemco's Application Note #023-9002, dated March 10, 1980, or until the 8-volt DC supply is as close to 8 as possible. This notice is supplied with all new systems' documentation, and is available separately from dealers.

Phantoms, witches, or glitches with Cromemco hardware or software? Write to me, Richard Quinn, or TEC TIPS, c/o I/O News, and explain your problem. Maybe we can help. Also, if you have found solutions to baffling problems, pass them on to us for sharing.

Thanks,  
Richard Quinn



## Cromemco Introduces Software

Continued from first page

The IDS package also contains application software to support asynchronous communications via modem. This can be used with a 110, 300, or 1200 baud modem connected to a QUADART. The software is designed to support standard Bell 113C, 103J, or 212A modems or their equivalent. Complete source code is included for the asynchronous communications

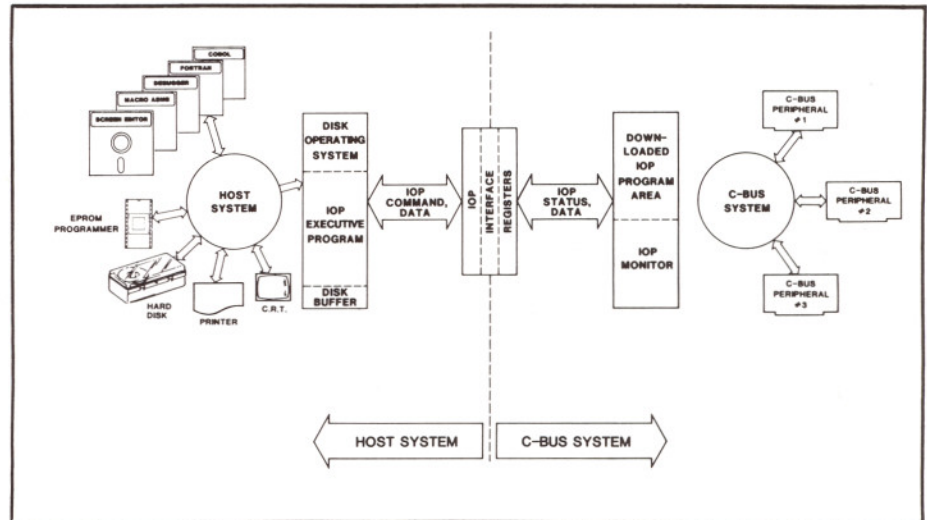
software so that it can easily be modified or enhanced for special applications.

The second new communications package is called the Remote Batch Terminal Emulator (RBTE). While the IDS package supports **asynchronous** communication, the RBTE package supports **bisynchronous** communication. It does this by emulating the bisynchronous communications protocol used by IBM2780, 3780, 3741, or 2770 type devices. The two big advant-

ages of the bisynchronous protocol are: first, the ability to communicate with IBM and IBM-like computers and second, the ability to communicate at up to 9600 baud using ordinary phone lines.

The IOP development software is available on either 5" or 8" diskettes as model IDS-S or IDS-L respectively. The Remote Batch Terminal Emulator is also available on 5" diskette (RBTE-S) or 8" diskette (RBTE-L). List price for each package in the U.S. is \$595.

**Figure 1.**  
IOP Development Software allows a programmer to use a Cromemco host computer to develop software for the IOP card, and then download it into the IOP memory.



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## CROMIX and Communications Aid Construction Company

By Akmal H. Khan

By now many Cromemco users have become quite familiar with the extremely powerful and very fast CROMIX operating system and have begun to find new directions to employ its formidable power. We at Building Construction, Inc. have recognized the immense potential that CROMIX offers at the comparative low cost and are fast moving into the microcomputer field. Hand-in-hand with this escalating interest in microcomputer systems in general and the CROMIX operating system in particular, there has been a growing need for off-site access to these computers. This is especially true for the construction industry where access to a computer from a construction site is no longer a hard-to-afford luxury. Nationwide public access data bases also make it very appealing for a computer to have the capabilities to communicate with a remote user or another computer, thus enabling the smooth flow of information to where it is most needed.

BCI is a small construction firm in Wisconsin. We made the determination that in order to be one step ahead in the construction industry we must find an economical and efficient computer system. We found that the Cromemco CDOS system would be the most useful tool we could have while staying within our budget. The rewards of this decision were so quick and overwhelming that BCI recently changed over to the CROMIX operating system to further exploit our new-found power in a multi-user environment.

It was at about this time that we also realized the need for a communications package.

CROMIX, being a new operating system, does not have a lot of easily available software in the market. That situation, however, is rapidly being rectified as more software manufacturers are leaping into the fray. Telecom 1.01 (see following note) was written at Data Tech, Incorporated primarily to aid BCI. This very versatile state-of-the-art communications package was the answer that we had been waiting for.

Telecom, now in its fifth version, opened up a whole new horizon for BCI. We now have a very sophisticated job-costing package on CROMIX which we can update from a construction site the minute changes are made to the original schedule or cost forecast.

Sales figures for BCI have also escalated since Telecom. The new breed of building salesmen carries Texas Instruments' Silent 700 portable teletype printers no larger and no heavier than their briefcases. Armed with this powerful tool they march with confidence into the offices of clients across the country and hook-up to the computer at BCI over the telephone. The salesmen are then able to run pricing, heat loss calculations, life-cycle costing, and other programs from that distance and present clients with accurate figures in a matter of moments. They can even have a contract printed out and have the client's signature without ever having to leave his office. The



air of professionalism that this project is difficult to duplicate.

The computer also reduces correspondence cost and time. The MAIL utility on the CROMIX operating system enables salesmen to exchange mail between each other. All that is required is a few minutes access to a telephone and confidential material is immediately at the disposal of the recipient regardless of where he may be. The users at BCI can have access to data bases such as SOURCE and US Govt. Survey Records by having Telecom dial these data bases and transfer the information to the local disc drive in a matter of minutes with the minimum of effort. This newly created file now becomes a database that is easily accessible by our personnel at a moments notice from anywhere.

As computers become more integral in our lifestyles, newer and easier to use software is constantly being produced. The computer user is no longer a very technically oriented individual with the knowledge of a number of programming languages but may well be a secretary with no more than a high school education if even that. Even for the programmer, it is no longer necessary that he be familiar with languages such as Assembler to perform major system modifications. Indeed, although many of us here are programmers, none of us has any experience with Assembler. In spite of that, we have managed to make substantial modifications to the operating system and to customize some of the device drivers on CROMIX. This was done using a library of subroutines from CPU which permitted us to make CROMIX system calls from high level languages such as RATTOR.

We feel that this is a very exciting era to be in. We are on the verge of the greatest revolution to hit the construction industry since concrete and the implications are breath-taking. Computers may never replace Man but they most certainly make life a whole lot more fulfilling!

(Editor's note: The author of the above article made several references to **Telecom**, communications software developed by Data Tech.

Inc. For the convenience of readers, we include the developer's overview of Telecom.)

TELECOM Version 1.04  
Data Tech, Inc.

### Introduction

Telecom is a state-of-the-art communications package designed for use on Cromemco machines in the environment of the CROMIX operating system. This is a very powerful package which permits maximum user versatility and ease of use. CROMIX system calls are used throughout the package to maximize the exploitation of a very fast and powerful operating system. Commands to Telecom are acceptable both in the upper and lower case. The package was written in such a way as to make it teletype independent. Thus, the user is not restricted to using a Cromemco 3102 for normal operations.

The package is designed to interface with a BIZCOMP 1031 modem. Modifications to the program for adaptation to a different operating system and/or to a different modem can be made by Data Tech, Inc. on request.

Some of the features of Telecom include auto-dialing, 32K Memory buffer with automatic disc dumps for transferring large files to and from the host computer, 24 programmable keys for frequently used strings such as a login sequence or a long command string, Invisible xmit mode for transfer of binary files and the ability to exit temporarily from Telecom to perform local operations without disconnection from the host computer.

Further information on **Telecom** can be obtained from: Data Tech, Inc., P.O. Box 157, Middleton, WI 53562. Phone: (608) 831-0011.

### About the Author

Akmal Khan is vice president of data-processing at Building Construction Inc., Middleton, Wisconsin. He has extensive experience in operating systems programming, both in the U.S. and in Europe. He is one of a growing number of experts on the CROMIX operating system. His skills include FORTRAN, PASCAL, C, Z-80 ASSEMBLER, PDP-11 ASSEMBLER, LISP, SNOBOL, BASIC, COBOL, and RPG-II.



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## A Program to Generate KSAM Files Using Standard Data Base Schema Formats

Continued from first page

large step forward occurs in systems which support at least one primary sort or identification key and one or more secondary or alternative keys. All that one needs is a proper layout or 'schema' of the data base displaying the field sizes necessary to support the DBMS. An implementation of this is made in the CROMEMCO DBMS and DBR (Data Base Report) system.

The greatest degree of programmer control might be found in DBMS systems which interface directly with a language or the entire system. The KSAM (Keyed Sequential Access Method) capabilities of CROMEMCO's 32K Structured BASIC represent such a system. Entire articles could be devoted to the structuring capabilities and to the variable passing inherent in the procedure calls available in the language, but KSAM is the main thrust of this article. It is KSAM, primarily, that makes this language especially useful in commercial applications. CROMEMCO's only slip occurred in the use of error traps rather than return variables after KSAM calls. As in any DBMS, it is necessary to set up a schema for practical use of the system. Suppose an inventory scheme is to be devised, remembering that all sort keys must be alphanumeric and that the primary field must be unique. Suppose we establish the following schema:

| KEYS         |                       | SIZE (bytes) |
|--------------|-----------------------|--------------|
| 1. PRIMARY   | Inventory control #   | 10 char      |
| 2. ALTERNATE | Type (Nut, bolt, etc) | 6 char       |
| 3. ALTERNATE | Location (e.g., A5)   | 10 char      |
| 4. ALTERNATE | Manufacturer's Name   | 20 char      |

### OTHER INFORMATION

|                     |                   |          |
|---------------------|-------------------|----------|
| 5. Description      |                   | 26 char  |
| 6. Price #1         | (full precision)  | 8 bytes  |
| 7. Price #2         | (full precision)  | 8 bytes  |
| 8. Quantity on hand | (short precision) | 4 bytes  |
| 9. Reorder quantity | (short precision) | 4 bytes  |
|                     |                   | 96 bytes |

We could use the KSAM calls in the manual to set up this schema, but the author uses a program which will set up the files for him as well as a '.DOC' file which will document the schema. The user is encouraged to try it and see for himself the ease of devising systems using the program. Once generated, the file management is fairly easy and consistent with the instructions in the manual.

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10  Rem KSAMGEN GENERATES KSAM FILES, PRIMARY & ALTERNATE & DOCUMENTATION
20  Rem Jordan Siedband, Skokie, Illinois (312)674-1175
30  Dim Key$(30),Altkey$(239),Info$(239),Prim$(11),Doc$(11),Z$(69),Alt$(95)
40  Integer Size(0,1),Info(11),I,N,Displacement,Ninfo,Bytes,X,Total,size
50  Altkey$(1)=" "+Altkey$(1) : Info$(1)=" "+Info$(1) : " "+Info$(1)
60  Mat Size=0 : Mat Info=0 : Ninfo=0 : Bytes=0
70  Rem Next Line Clears Screen. Otherwise use your own screen clear.
80  Open"3\SC0" : Put"3,0\ : 0 : "Generation of KSAM Files"
90  Input"Primary File Name (8 Characters or less, no punctuation) " : Z$
100 If Len(Z$)>8 Or(1+Pos(Z$," ",0)) Then Z$="" : 0 Chr$(7) : Goto 90
110 Prim$=Z$+" .PRI" : Doc$=Z$+" .DOC" : Key$(-1)=" "+Key$(-1)
120 Input"Name of Primary Key (Include $) " : Key$
130 Input"Number of Bytes in Primary Key " : Size(0,0)
140 Input"Number of Alternate Keys (8 maximum) " : N : 0 : If Not N Then 250
150 If N<9 Then 170
160 0 Chr$(7) : "MAXIMUM NUMBER OF ALTERNATE KEYS = 8 ***" : 0 : Goto 140
170 For I=1 To N
180   Z$=Prim$(0,Pos(Prim$," ",0))+AL"+Str$(I)
190   0"Alternate Key #":I : FILENAME : " : Z$
200   Alt$(12*(I-1),-12)=Z$
210   Input"Name of Key variable (include $) " : Altkey$(30*(I-1),-30)
220   Input"Number of Bytes in Key " : Size(I,0)
230   Size(I,1)=Size(I-1,1)+Size(I,0) : 0
240   Next I
250  Rem NOW INPUT OTHER INFO IN ORDER OF STORAGE
260  0"12 items allowed in addition to keys"
270  0"Name of INFO item ($ if string) #":Ninfo+1 : Input" (0=out) " : Z$
280  If Z$=0 Then 320
290  Info$(20*Ninfo,-Len(Z$))=Z$
300  Input"Number of Bytes " : X : 0 : Bytes=Bytes+X : Info(Ninfo)=X
310  Ninfo=Ninfo+1 : If Ninfo<12 Then 270
320  Rem GENERATION OF FILES STARTS HERE
330  Total=size+Size(N,1)+Size(0,0)+Bytes
340  Kcreate"Total"size,Size(0,0)\Prim$
350  Kopen"1\Prim$
360  0"PRIMARY FILE " : Prim$ : "GENERATED!!" : Create Doc$
370  Open"2\Doc$
380  0"KSAM PRIMARY FILE : " : Prim$
390  0"KSAM PRIMARY KEY : " : Key$ : Tab(40) : Size(0,0) : " BYTES"
400  If N=0 Then 510
410  0"ALTERNATE KEYS -----"
420  0"NAME",Tab(40) : "SIZE (BYTES)"
430  For I=1 To N
440    Z$=Alt$(12*(I-1),-12)
450    Displacement=Size(I,1)-Size(I,0)
460    0"Altkey$(30*(I-1),-30) : Tab(40) : Size(I,0) : Tab(50) : Z$
470    Kaltcreate"1,Size(I,0),Displacement"Z$
480    0 Z$ : "CREATED!!!" : "Size(I,0) : " BYTES"
490    Next I
500  0"OTHER ITEMS"
510  0"NAME",Tab(40) : "SIZE (BYTES)"
520  For I=0 To Ninfo-1
530    Z$=Info$(20*I,-20)
540    0"Z$(0,-20) : Tab(40) : Info(I)
550    Next I
560  On Esc Goto 600
570  0" : 0 : "Enter any comment lines for DOC file. ESC gets out. ...."
580  Input"COMMENT : " : Z$ : 0"Z$ : Goto 590
590  Close : 0 : 0 Chr$(7) : "KSAM & DOCUMENTARY FILES ARE NOW CREATED"
600  0"TO VIEW, GO TO CDOS AND TYPE OUT FILE."
610

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### About the Author

Jordan Siedband, Professor of Physics at Harper College, Palatine, IL, received an E.E. degree from the University of Cincinnati while still in uniform in 1944. After WW2 he received his BS and MS in mathematics from the University of Chicago, and took most of his course work for the Ph.D. in Mathematical Physics from Illinois Institute of Technology. He has been a CROMEMCO user since 1977. His consulting began in 1970, mostly on table-top programmable calculators./computers, where he learned the important lesson "think small". Since then, he has worked on larger systems, which was the major factor in choosing CROMEMCO in the first place. His engineering background has been eminently successful in solving scientific as well as business problems.



# Double Entry Bookkeeping

Continued from first page

Now what has double entry bookkeeping got to do with a genteel sufficiency? Everything. The hackneyed phrase, "the bottom line..." is widely used and commonly taken to mean the "final answer..." or "the real message..." As a matter of fact, it is just that, but most people have no idea what the bottom line is the bottom line of. It is a colloquial phrase applied, for example, to the final line of an Income Statement which is properly called Retained Earnings. If the books are set up in a certain way, it can represent one kind of profit. Retained earnings are the funds left over after Income has been totalized and all expenses deducted from it. "Profit" may be an affair for the business world but Retained Earnings is the key to understanding where the home life is heading in the financial department. It isn't exactly profit in the strict business sense, but it will be that part of your income which you did not spend to keep your family operating that month. If it is positive, it increases your Equity, your Net Worth.

To learn accounting, including its subsidiary art, bookkeeping, used to be a necessary prerequisite to running up a set of books. No longer. The home computer is here. Any home computer? No. There is a limit to what can be accomplished with a mini-micro. The key word in bookkeeping is keeping. Records. Without records, Uncle Whiskers will not be able to tell where it came from and where it went. He will likely think the worst. But a generation of Americans have grown up satisfied if they can do an honest job of putting up an annual income tax form. There is a lot of useful information in an income tax return, and a lot of bookkeeping effort had to be expended to assemble that required data, but the information is designed to be useful to the Feds, not to the Family.

So records. Two kinds of records: magnetic storage and hard copy. This sets some minimums on the system that will truly be useful to you, your spouse, and your get.

Two disks are really the practical minimum. Remember that key-word "keeping". Back-up is the name of the game. Mechanized back-up. As a desperate last resort, and if one has kept properly updated hard copy, it is possible to recreate on magnetic material an entire set of books as of the most recent hard copy up-date. However, this is no small chore, so plenty of magnetic disk back-up is valuable insurance. Keep your account files on your "master" accounting disk and keep two back-up copies. The second back-up disk serves a very important function: suppose you have some disaster, a power failure, for example, while you are backing up your account files on back-up disk number one. You really cannot be sure what is on either of these two disks. A corollary to this proposition is that back-up disk number two should be inactive except when in actual use so that it cannot also get messed up in the general catastrophe. Back-up is valuable insurance.

And a printer. Most full dress bookkeeping systems require 132 columns of print. Keep this in mind when you pick out your hard copy machine. On the other hand, you don't need lower case characters, so if you are squeezing, there is one option you can lop. Lower case is nifty for word processing, but there is lots to be said for more speed in printing, and I have been word processing for years in upper case and like it fine. If, like me, you are no longer a spring chicken, that larger print reads mighty nice.

Obviously, you need a terminal with cathode ray screen and keyboard. It ought to have the cardinal elements of cursor control. If it does not, someone is going to have to program around this lack, since most business systems suitable for personal financial accounting require cursor control.

This matter of cursor control should not be dusted off lightly. Much depends upon exactly where you fit in the user-user/programmer-user/expert spectrum. Sophisticated computer programs for

business usually have lots of hand-holding features. The general intent is for the information to be put in by an employee in a relatively low-pay category, while the reports are to be generated by someone who, while he or she may be expert at accounting, is not particularly knowledgeable about computers. Therefore, generous use is made of CRT Masks and the "Menu" technique. Cursor control is the name of the game in this sort of program. Far and away the commonest hang-up in installing an accounting program is incompatibility between the program and the cursor control commands required by the particular terminal or the exact way in which the terminal and the computer interact to convey screen characters to and fro.

Now, you have to keep records no matter what, for two reasons at least. It is silly to have a check bounce because you didn't balance the check book properly. It is a lot more serious to make a major mistake in filling out your income tax form. Arithmetic errors usually lead to forgiveness (after a nick for interest on money due) but other errors lead to audits and that can be very trying indeed.

What you will find when you start to look into the matter is that you are doing a partial job of bookkeeping and getting no special benefit for all that work. The Internal Revenue Service is interested in seeing to it that the tax laws are obeyed to the letter, period. They couldn't care less if your personal finances are going to hell in a wheelbarrow, unless you happen to go bankrupt owing them money. Managing your family finances is just not part of their job. It is part of yours.

So why not do it right? In the dark days before home computers, it was a very difficult thing to do. For starters, that course in accounting. Then the hand posting of the factual data. Then the introduction of these data into the income statement. Then the recalcu-

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# Double Entry Bookkeeping

Continued from page 11

lation of the balance sheet. It is not surprising the phrase is "trial balance." It sounds as though it were expected that you would get it wrong. That's right, you do get it wrong, and sometimes again and again and again. If you are not a light fingered artist on a ten key desk calculator, you haven't a chance.

So what have computers changed? All that arithmetic but, and a much more important but, also, they can be programmed to enter the data correctly the first time into the report generation process, once the information has been posted. There probably is not too much time difference between hand posting and posting on a computer, but the payoff comes when the posting is done. In hand bookkeeping, when everything is properly posted, you are merely off to a good start. The income statement and the balance sheet are yet to come. The computer does them. Does them right the first time if you have posted correctly.

So what difference does that make? Everything. You know what is going on in your family finances. You know month by month whether you are gaining or losing ground, headed for that Florida vacation, or, the poor house over the hill. Most of us have spent most of our lives watching our savings account as a sort of financial barometer. If it was rising, things were in good shape. If it was falling, things were not so hot. Well, that's one way to do it, and it works in a crude sort of way, but it does nothing to tell you why it is rising or falling.

There are a few well-disciplined adults who have been able to write a budget and stick to it, but I'll bet there are more people writing articles about what a wonderful thing a budget is than there are people really living on one. A properly kept set of books is better than a budget. It is for real, a budget is a hypothesis, and, sadly, often an unrealistic one. Later in this article, I will reveal a secret weapon for the battle of the budget which will really help you win. Meanwhile, back to basics.

Buy a book. One I like is "Elementary Accounting" by Royal D.M. Bauer and P.H. Darby, College Outline Series, Barnes & Noble Publishers. I have the Fourth Edition. Don't try to become an accountant, but you will need to poke around in some such book to get a grasp of the general principles. You will need to look up some things when the documentation of your program uses a technical term without defining it. The documentation I have reviewed abounds in undefined technical terms.

Bauer and Darby succinctly distinguish accounting from bookkeeping: "Bookkeeping is the systematic recording of business transactions in financial terms. Accounting covers a wider field, which includes bookkeeping and involves the design of business records, data analysts, preparation of reports based on the records, and interpretation of the reports." I don't think you want to become an accountant, and you won't without a lot of study, but you must become more than a bookkeeper. I suggest you become a Family Financial Wizard. It is a lot easier than becoming an accountant, and a lot more useful than becoming a bookkeeper.

Why? Because a well kept set of books is, thanks to small computers, now easily within the reach of anyone likely to be able to operate a computer at all, and this without expenditure of much more effort than is currently going into check-book balancing and record keeping for the I.R.S. You will know from month to month where you stand and why.

How? Well, the thing to do is to operate the family as though it were a business. It is a business. The most important one in the world to you.

You and your spouse and your kids are a joint venture. You have income and you have expenses. You own some things. You probably owe some money, most likely a mortgage, maybe other long-term debts, and surely some bills payable. The trouble with the sort of records you keep for the tax collector is that all personal expenses

are pushed to one side since Uncle Whiskers regards all such as non-deductible and the hell with them. But you can't live without food and drink and housing and clothes and these are the expenses required in the joint venture in which you are inevitably engaged. So, the Income Statement: so much money came in and so much was spent. The difference is Retained Earnings. Some months it might be negative. If it is negative very many months, you are heading for trouble. If it is negative for a couple of quarters, things really look bad. George Humphrey said it all in one sentence:

"I don't think you can spend yourself rich."

The difference between a real set of books for a family and the sort of records which might satisfy the I.R.S. is that the real set of books includes the non-deductible, that is, the personal expenses as well as the deductible ones, and it keeps them carefully separate. Therefore, when you set up your chart of accounts, you must set up a category of personal expenses as well as a category of expenses which would be deductible under I.R.S. Regulations.

The balance sheet will have three kinds of entries: Assets, Liabilities, and Equity. The fundamental accounting equation is:

$$\text{Assets} = \text{Liabilities} + \text{Equity}$$

It would be more meaningful to rewrite the equation thus:

$$\text{Assets} - \text{Liabilities} = \text{Equity}$$

Because you want to know what your equity is. This is commonly called "Net Worth". It is what a banker wants to know if he is considering loaning you money. And he wants to know how you arrived at that figure. That requires a "Balance Sheet", but in the way in which it is usually prepared by the average citizen, it is rather a loose document. For example, the value of the home is entered as a guess at Fair Market Value minus the unpaid part of the mortgage on it. Proper books will have the assets entered at cost, and any improvements, for example, an addition to the home, would be entered as additions, or if you had sold off some of your land, you would enter that



negatively as a retirement. After you have your balance sheet in correct shape on a cost basis (which is the only basis Uncle Whiskers believes in) then, if you wish, you can run up a separate Balance Sheet on a "Fair Market Value" basis. Your banker will be impressed if you show him both. He has long ago learned how to de-fat a one page bank-form "Statement of Net Worth".

You know as well as anyone what your assets are. An asset is anything you own: cash on hand and in banks, securities, money people owe to you, land, building(s), furniture, durable household goods and chattels, equipment, and such.

A liability is anything you owe to someone else, including Uncle Sam, i.e., taxes payable, the mortgage on your home, the new car loan, etc.

When you have deducted the liabilities from the assets, you have your equity. You may want to separate your spouse's equity from your equity, and in some cases, maybe one or more children also have some equity. Finally, there will be joint venture items of equity, most commonly the home, since a home is usually owned jointly by husband and wife. It is also well to post your Retained Earnings to a joint venture item entitled "Undistributed Retained Earnings" month by month, and then at the end of the year, make a distribution of this to each of the individual equity categories. You can have a nice discussion with your spouse as to how it would be fair to divvy it up, especially if it is negative for the year.

If it is negative for the year, you had better change your ways. Sell your home and move into a smaller one. The size of your home is the basic determinant of your cost of living. In a big home, the water bill and the electric bill and the fuel bill and the furniture bill and the curtain bill and the rug bill are all also big. Even the food bill. You don't eat any more, but at the larger parties you give the guests eat more.

"Income one pound six pence,  
outgo one pound five pence,  
happiness. Income one pound  
five pence, outgo one pound six  
pence, misery."

Charles Dickens

Now where, exactly, did this "Retained Earnings" item appear from? It is the tie that binds the Income Statement back to the Balance Sheet. The Income Statement is prepared first, after all the postings have been entered into the general ledger accounts. It normally consists of two parts, Income and Expenses. In your case, you must have three parts. Income is income is income, but expenses of different kinds have different effects upon the tax collector, so you must set up two categories of expenses. The first is personal, the second will contain the kinds of expense which are normally deductible under the Internal Revenue Service Code.

These latter will vary from family joint venture to family joint venture. This is one of the places where you really need guidance from a professional, preferably a Certified Public Accountant. Why you need him is explained below. Don't leave home without him.

You may have some sorts of business you operate out of your home, for example, some rental properties. Your wife might be a sculptress. Mine is. If your's is too, I don't need to tell you there are going to be sculpture expenses, but I am most certainly not going to try to tell you how to decide whether her sculpture work will be viewed as a legitimate professional activity of whether the feds will say it is a hobby. If your Certified Public Accountant is very, very good and if he is articulate and blessed with a talent for lucid expository prose, he may, just maybe, be able to explain to you the I.R.S. rules and regs. on the subject. I suggest you ask him to tell you where to put the item, personal expense or professional expense, and not try to make you understand why unless you would enjoy an extended discussion of one of the weirdest topics in the history of taxation.

Back to the Income Statement. It may not be obvious how to post certain types of income. For example, if your income includes salary, your employer will chop out a number of dollars here and there to pay such things as federal and state income tax withholding, FICA, maybe something into your credit union account, and last but

never least, some items euphemistically called fringe benefits.

You need to keep track of these items pretty carefully. A very useful trick for this is to set up a cash account to which you post the gross amount of each paycheck and, at the same time, post that amount to an income account called "Salary - Gross". Now, having posted these as receipts, turn around and post disbursements from that cash account to the various objects to which your employer has kindly distributed your hard earned dollars. Thus, this account will rise abruptly from zero each month to the astronomical level of your gross monthly salary and then, as you disburse from this account, it will slowly wither its way back to zero as you spread the largesse around to the various objects like hospital insurance and withholding taxes which vulture it away to the painfully small amount you finally note has been deposited in your checking account, your poor and pallid "take home pay."

Turning to personal expenses, some of these are actually tax deductible, for example, donations, but these still should be put with the other personal expenses. There will be no problem finding them come Form 1040 time.

Unless you are a bear for detail, not much is gained trying to break out many personal expenses in detail. The game is to break out the ones you might be able to control and put the rest into some such account as "personal supplies and expenses". Be sure to have a companion piece, "personal supplies and expenses refunds", otherwise you will be sitting there one night with a refund check from a mail-order house and find no place to post it. You certainly do not want to post it to an income account. It has been your money from the day you sent it off to the day you won your hard fought battle with the mail-order house computer and got it back at last!

I happen to engage both in business and in professional activities. In the former, I am an entrepreneur while in the latter I am salaried by a university but also have professional fee income of several sorts. For the kind of work I do,

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# Double Entry Bookkeeping

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some entertaining is a legitimate deduction, some is not. Some items really have to be prorated to personal and to business and professional expenses, for example, club dues when the club is used both for personal and for business or professional entertaining. Once again, ask your C.P.A., unless you enjoy reading vast volumes of federal prose.

If you are 100% salaried, and zero percent into business, a profession or other gainful activity outside your salaried job, then it isn't sensible to set up a lot of business and/or professional expense accounts for expenses you do not have. In this event, it would make sense to separate your expenses entirely on the basis of whether or not a tax deduction were involved. For example, interest you have paid on your home mortgage is deductible. Entertaining usually is not, unless reimbursed by your employer if you are 100% salaried. Then you would need to show expenses due to entertaining on behalf of your employer, and show the reimbursements from your employer as income. Better see that C.P.A.

Getting down to brass tacks, don't underestimate that difficulty of installing an accounting system. The first question is what do you need? You need a General Ledger. This will cost anywhere from \$100 to \$1000 depending upon which one you decide to buy and from whom you buy it. There is a good deal to be said in favor of obtaining one from your local computer dealer, especially if you can get some assurance that you will get the help you will surely need in installing it.

Unless you are really in business, or one of the very rich, you don't need a payroll program, an accounts receivable program, nor an accounts payable program. A good general ledger will do your job. I tried several, and settled on the Osborne General Ledger, the CBASIC-2 version which came out early this year. Unless you are pretty hot at CBASIC-2 programming,

you are going to need help installing this system. You had better buy the program through that local dealer who is disposed to be helpful. You can run up a pretty good long-distance phone bill debugging any such program without local help unless it has been carefully tailored to your computer configuration.

For example, there is a lot of difference among terminals as to cursor addressing routines, and there are other pitfalls in such matters as how the computer enquires what the console has to say and just how the console responds to such queries. Sadly, there are also a few mistakes in the Osborne material itself, but there are being debugged continually, and your dealer should have all the dope on any needed patches.

One way to go, although it is not likely to be cheap if the firm is any good, is to hire the installation done for you. Once the program is up and running, it is fully handholding and the documentation for the operator is very good. For the programmer, it is only fair, and this is a sophisticated program with lots of nifty-craft tricks in it. This is good, because the program has been around a long time and has been nicely polished, but it is not for amateurs to rework!

Let us assume you have the skill to install it yourself and have done so, or that you have hired a hot-shot computernik to do it for you. Now is the time to get with your Certified Public Accountant. If you have your own computer, and you need an accounting system, you need a Certified Public Accountant. In the first place, if he can't save you his fee and then some in your income tax, either you don't have enough income to make an accounting system worthwhile, or you have a lousy C.P.A. This saving is not because the C.P.A. will do anything wrong. On the contrary, it is because he knows exactly how to do it right. Once again, if you don't have an income tax problem, you don't have enough income to need a computerized accounting

system. A well balanced check book and a shoe box of receipts will do your job just fine.

Make up your own chart of accounts using the Osborne manual, which has a very good section on this topic, plus your reference book, plus any ideas of your own. Go through last year's check stubs and see what kinds of accounts you ought to establish to pigeon hole information you want to record. Don't overlook your spouse's check book. It may be a mine of potential deductions, although it is more likely to be a documentation of the rapacity of hairdressers and of the convenience of supermarkets as places to cash checks. When you have your draft chart of accounts then go over it with your accountant. This is for two reasons. He will have some good ideas about the chart of accounts generally, but, more specifically, it is important that it suit him when income tax time comes around.

Remember, with your own computer, you can have a full chart of accounts which will give you lots of detail about where the money is coming from and where it is going. A big chart of accounts is a nightmare if it must be processed by hand, but with the power of the computer, you can live with a chart of accounts that could look like General Motor's. You can use the printing routine in the Osborne Accounts Maintenance File to list out the regular accounts. These are the only ones to which you post. I did this on the back of green bar paper to get a cleaner looking copy and then cut off just the account number and name in strips and mounted them on a piece of cardboard. This I prop up over the scope on the terminal so it is easy to look up account numbers. I marked off the various categories with a red felt-tipped pen, using double and triple lines to separate major divisions. This speeds the search for account numbers.

If you find you have gotten carried away, it is no big deal to throw two or three accounts together using the Account File Maintenance



Program. By the same token, it is easy to add accounts, if unforeseen needs occur.

This is a good time of year to get into this line of work. If it goes slowly, you will be in full form by the beginning of 1982. If it goes fast, you will have part of a year to sharpen up your practices to produce the answers you want and you might even go back to the beginning of 1980 to pick up tax relevant items individually, while batching personal expenses for the early parts of the year. By doing this, you will deprive yourself of the real benefits of the system as a financial barometer for your family affairs, but if you are a real hero, you could go back and post the whole early part of the year in detail. The information should all be in your check book or your desk drawers.

Finally, the secret weapon! The Osborne General Ledger Program was written for businesses. Businesses sell things. People who own businesses like to relate their income and expenses to sales, each as a percent of sales. To meet this need, the Osborne program allows one to flag the sales accounts. Such flagged accounts are totalized and then each and every item in the income statement is expressed as a percent of sales. Well, my family does not do much selling, so this part of the program looked to me to be excess baggage for my purposes until I had a great thought. I estimate our gross income for the year and post one twelfth of it each month to an account called "1/12 Budgeted Annual Income" set up as a credit account (Credit Account? Go look it up in your book). Then I post exactly the same amount to an account called "Budgeted Annual Income Offset" which I set up as a debit account (Debit? Look it up). This account I do not flag as a sales account. By posting the same sum first as a credit, then as a debit, the transaction is wiped out as far as having any effect on balances, but the computer still thinks there have been sales in an amount representing one twelfth of the budget. Consequently, it proceeds to express all income and all expense account balances as a percent of budget instead of the non-existent sales.

This is pretty nifty as a tool for studying each month's activity, and it carries over correctly to the quarters too!

Finally, what is so great about a double entry system? The merit of the double entry system is that everything goes into it twice. For example, when I deposit a consulting fee, it is posted to my checking account and it is posted to an account called "Consulting Fees". However, one is a debit account (the checking account) and the other is a credit account (Consulting Fees). The effect of this is that one offsets the other when all the debit accounts are totaled and compared with the total of the credit accounts. Thus, there is a powerful internal error detection system at work in each and every pair of postings. Nothing will make any accounting system fool-proof, but the double entry system comes close.

Table I presents a Chart of Accounts essentially as used by the author, who conceives himself an ordinary enough man to have ordinary enough needs for an accounting system. The trouble with most "General Ledger" programs is that they were, logically enough, written for businesses. It seems to have escaped the minds of our software writers that there are a lot more people out there than there are businesses. A lot of those people would be into computerized bookkeeping if the systems were designed for people. People commonly occur in a system known as the family, man, wife, and, in the due course of time, offspring.

Fortunately, a credit is a credit is a credit and a debit will forever be a debit. Therefore, if the Chart of Accounts is properly set up in the first place, a system that will work for business will perform work for a family. Business charts of accounts are larded with non-useful rubrics: Trade Accounts Receivable, Finished Goods at Manufacturing Cost, Freight - In, Vacation Accrued Liability, Patent Royalties, Development Project Expenses, Sick Leave Pay, Trade Shows, Brochure Printing, Transfer-In from other Departments, and a variety more things not applicable to Mom, Pop and the

Continued on next page



# TRI-STAR

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# Double Entry Bookkeeping

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six kids.

Although the chart proposed is ordinary enough, every family is unique and it is given merely as an outline to work around. When you have the chart of accounts put up to suit you, it is important to ask your Certified Public Accountant to say a few words over it. Since you are really substituting the savvy of the original programmers for a hard earned knowledge of accounting, it is easy to make a really big boo-boo. If the chart of accounts is right, and you learn how to post to it, the computer will take it from there.

The Osborne General Ledger offers two ways to post. One is "Direct Posting". It is simple and single. That is, you post to one account at a time. That means, for the double-entry system, every item will have to be posted twice, say once to a cash account, and once more as a credit or a debit to some other account. The direct posting system is ideal for making corrections and adjustments, but the other system offered is much better for routine postings. The "Cash Journal", which, incidentally, also keeps a very good journal, is a valuable part of the audit trail you must maintain. Otherwise, there will be no way to know how the books came to show what they do.

With the Cash Journal, for example, you can set up your regular bank checking account as the "Cash Account" and set the program for "Receipts." Now you go through your check book for the whole month spotting all the deposits. Each is then posted to the checking account as "Money In", and it is posted to the relevant double entry account at the same time, with a reference number. For this latter purpose, I use the number of the check nearest to the deposit, adding 99 as a code to tell me it means "Near", so if the nearest check number is 2157, my reference number will be 215799. The cash journal also permits a short English language statement. You soon develop the knack of putting in a meaningful identifier for each transaction, e.g., "Olive Note In-

terest" or "Olive Note Principal" as you divvy up the note payment into its two component parts and correctly assign them to account 45707.5 and 22707.0. By now you have surely noted that I have tried when possible to make account numbers meaningfully mnemonic.

While posting receipts, I hold off posting my university salary check to the last, which is appropriate anyway, since it is sent to the bank for me, to arrive on the last day of the month. I call up account 11160.0 Salary Income Account and put the gross amount of the paycheck into it, at the same time, putting it into the income account No. 31200.0 Salary - Gross. Then I turn around and disburse from the Salary Income Account to all the objects my university pays for me, finally sending the net salary amount to my checking account No. 11120.0. The merit of doing this was discussed in an earlier part of this article.

The Cash Journal can also be used efficiently for many corrections. Suppose you have posted a disbursement from your checking account correctly as to amount, but you posted it to the wrong expense account. You could set up the account which received it incorrectly as a cash account and disburse from it to the account which should have received the posting in the first place. You must take care when you do this not to cross up the program. When you process the correction posting into the general ledger accounts from the external posting file, look closely at the two accounts involved to see that the correction went in the right direction in each case. If it did, fine. If not, you are in debit versus credit trouble and you had better correct the correction with some direct postings.

A few points about this particular chart of accounts may be worth examining. The balance sheet items are all on a Cost or "Book Value" basis, because that is the only basis useful in connection with income tax. As earlier remarked, you can if you wish set up a second balance sheet on a "Fair Market

Value" basis, but it is a shower, not a blower. If you sell your home, the Capital Gains tax will be figured on the basis of what you paid for it originally plus what you can show you have added as improvements since. Therefore, it behooves you to catch up every little improvement you do make (that is a genuine addition) because you will never be able to remember it all when you sell if you don't have records. That failure will cost you a pretty penny in Capital Gains Tax someday.

Earlier, I said everything in the balance sheet ought to be on a cost basis. This is not fully true. The only things that must be on a cost basis are those things that need to be on a cost basis for income tax purposes.

The feds are taking a very dim view of offices in homes these days, and before you try that, ask your C.P.A. On the other hand, they recognize that some office functions must be performed, and accept reasonable deductions for needed equipment, including computers, if it is not a toy or used primarily for games. If you operate real estate and manage it yourself, obviously you need some things like a shop, yard equipment, a truck, etc. Keep in mind the general principal that the production or even the potential production of income is the test for whether an activity is or is not a business or profession. If an activity is notable for its lack of income production for a period of years, it is suspect as a reason for deductions. If you live on a country estate and buy a riding mower, while your downtown area real estate has four square feet of scrubby grass, that riding mower would emit a rather strong odor of fish. On the other hand, a pick-up truck would be a valid deduction.

When it comes to depreciation, better put yourself in the hands of your C.P.A. again. One of the reasons for separating additions (retirements) from real and personal property is that the rate of depreciation is going to be different for different kinds of additions: so many years useful life for



carpet; so many for air conditioning units; etc. All will be different from the rate for the building. It doesn't make any sense for a family to figure depreciation more frequently than once a year. Then pick up once-a-year entries from your C.P.A.'s schedules.

Your liability accounts are pretty straightforward. You will need to post to them monthly. Some of them will delay you, as you may have to wait to see exactly how the payments to interest and the payments to principal were made on those notes that are "running on a book" rather than on a table. Most modern thrift institutions have gotten away from the "payment book" but some, especially banks, still like them. If you figure the interest yourself, you will find that every month there are a few pennies favorable to the lender, unfavorable to you. There is not much you can do about this. Sometimes, however, it gets out of hand and you have to call the bank on it. Once I found charges up to 12% on a 10% note, called it to the original lender's attention, and she agreed to direct the bank to follow a monthly amortization table.

Keep in mind that one of the objectives of your books is to keep you informed of your net worth. This will be the basis upon which you may seek to borrow money. Even if part of your assets are "Estimated", such as the furniture and fixtures in your home, this will be acceptable if the item is so marked and if it is within the bounds of reason. It had better have some coordination with what you are carrying as insurance on the contents of your home.

The "Total Owner's Equity" is, of course, the "Net Worth" of the family. This is really another "bottom line", and for the long haul, the important one. Retained Income in the Income Statement will tell you in what direction you are going, month-to-month, quarter-to-quarter, but, at years end, you will incorporate Retained Earnings into Paid-In Capital, so from year-to-year, your Net Worth is the real proof of the pudding. As earlier remarked, the annual redistribution of Retained Earnings can make the subject for a nice winter's evening chat between husband and

wife.

The "Proof" at the end of the Balance Sheet is the test of whether you have done your posting job well and correctly. The difference between credit and debit accounts should be zero. If it is not, something is wrong and the error needs to be tracked down and corrected. If you have elected to use the Osborne General Ledger Program, you will have a print-out of all your postings, whether direct or through the cash journal and you will have a detailed record of just how the program distributed these postings, account-by-account, to the General Ledger. This is accomplished by the General Ledger Update Program, which prints out each transaction as it performs it. Search for the error is therefore much simplified.

With regard to the income accounts, the use of the "Sales Account" flag to obtain, with the Osborne Program, a relation of each income statement account to projected annual income on a percent basis was explained earlier. Note that the only real sales account, 31100.0 Sale of Sculpture is not flagged as a sales account. This would disrupt the other use we are making of that part of the Osborne Program. Original sculpture is not the hottest selling item in the best of times, but keep in mind that the I.R.S. will want any sales recorded as income.

Rent should be recorded apartment unit-by-apartment unit, and, in the Cash Journal, you should note the dates of the period for which the rent is paid. Thus, at least once each month you will review whether your tenants are paying timely. You really ought to watch this closely.

Personal supplies and expenses will be a big item. You could break it down as finely as you might wish, food, clothing, recreation, or even more finely, coats, pants, dresses, underclothing, shoes, etc. But this is really silly to do. The aim is to accomplish something useful. For the last six months, our total personal expenses ran 36%. Neither of us are much given to personal finery, and both of us are prone to obesity so we diet like mad at home. Consequently, it is

Continued on next page

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pretty unlikely we could ever get rich by pruning down in this department.

The pocket money item, Account No. 41260.0 deserves a comment. When one cashes a check for pocket money, here is a place to put it. However, once in a while, such a check should be posted to 11180.0 petty cash to keep a small balance in that account. It is often convenient to pay cash out of pocket for some item of supplies for the office, or for the rental property. One arrives home with the cash ticket, and the question then is what to do about it. Well, just set up 11180.0 petty cash as the cash account with the cash journal program and disburse from it to the appropriate object, say No. 43220.0 office supplies. You will be crediting one account and debiting another and the books will still balance. But save that receipt! Document every transaction!

Much of the rest of the personal expense accounts is a matter of personal preference. For example, a lot of the insurance premium accounts are grouped together. This serves to remind one how much is going for insurance, but it also serves to alert one to the possibility some policy may lapse. Also, it takes a lot of study these days to decide whether one is over or under insured. How can you tell? Consult an expert maybe.

Some items which are personal expenses are also tax deductible in whole or in part, donations, for example, so it helps to break these out where they are easy to get at for tax purposes.

The business and professional expense accounts begin to look more like what one is accustomed to seeing in an actual business. The detail should be a function of how much one is really into activities outside of one's regular salary if the latter is the principal source of income. One thing is certain, however. If you are going to make much in the line of business and/or professional deductions, keep good records. Robert Lee Frost had it all wrong:

Never ask of money spent  
Where the spender thinks it went.  
Nobody was ever meant  
To remember or invent  
What he did with every cent.

Don't be like that. You must be prepared to document every item. It is not enough to have a check stub. You need the cancelled check and you need the documentation of exactly what it went for. Receipts ... file them. Bills ... save them. Write on the face of each bill how you broke it out and staple the chits to it. Have a separate file folder for each substantial account. Often there should be two file folders for an account. One should contain the documentation of the current year's transactions, the other should be the permanent file for that account. At the end of the year, pack up the annual files in an orderly manner and put them in transfer files or boxes with all relevant papers. Make new annual files for the accounts that require them. The computer can help you mightily with your bookkeeping, but it will not carry last year's files up to the attic for you, not yet, that is.

Finally we come again to the bottom line: Retained Earnings, a sort of "Family Net Profit." Above we philosophized about the significance of this item. It is the month-to-month barometer, showing clear or stormy weather ahead. For the short term, it is the valuable outcome of this exercise in double entry bookkeeping. For the long term, your net worth tells the story.

### Legend For Table

Table I

Table I proposes a chart of accounts for a family in which it is supposed the family has elected to operate as a joint venture and that the husband's salary is the major source of earned income but that husband and wife may engage in various sorts of outside activities, for example, professional sculpture, as is the case with the case with the author's wife, and consulting work by one or both parties. Another source of income is from investments, which include real estate.

In this family, as in many others, the husband and wife are separate in property, that is, the husband and wife each own certain assets and these are not to be comingled. Some other things, for example, the family home, are jointly owned.



TABLE I

## A CHART OF ACCOUNTS FOR A FAMILY JOINT VENTURE

## BALANCE SHEET ACCOUNTS:

| NUMBER                                    | ACCOUNT NAME                          | KIND   |
|---|---------------------------------------|--------|
| =====                                     |                                       |        |
| ASSET ACCOUNTS                            |                                       |        |
| =====                                     |                                       |        |
| CURRENT ASSETS                            |                                       |        |
| =====                                     |                                       |        |
| CASH ACCOUNTS                             |                                       |        |
| 11120.0                                   | L&K BANK, CHECKING ACC'T, HUSBAND     | DEBIT  |
| 11130.0                                   | L&K BANK, CHECKING ACC'T, WIFE        | DEBIT  |
| 11140.0                                   | L&K BANK, SAVINGS ACC'T, HUSBAND      | DEBIT  |
| 11150.0                                   | L&K BANK, SAVINGS ACC'T, WIFE         | DEBIT  |
| 11160.0                                   | SALARY INCOME ACC'T, HUSBAND          | DEBIT  |
| 11170.0                                   | EMPLOYER'S CREDIT UNION, HUSBAND      | DEBIT  |
| 11180.0                                   | PETTY CASH                            | DEBIT  |
| TOTAL CASH                                |                                       | TOTAL  |
| =====                                     |                                       |        |
| MARKETABLE SECURITIES                     |                                       |        |
| 11510.0                                   | E.F.HUTTON CO. ACC'T, HUSBAND         | DEBIT  |
| 11520.0                                   | L&K CTF, DEPOSIT, WIFE                | DEBIT  |
| 11550.0                                   | OTHER MARKETABLE SECURITIES           | DEBIT  |
| 11598.0                                   | GAIN (LOSS) ON SALE OF SECURITIES     | DEBIT  |
| TOTAL MARKETABLE SECURITIES               |                                       | TOTAL  |
| TOTAL CURRENT ASSETS                      |                                       | TOTAL  |
| =====                                     |                                       |        |
| PROPERTY AND EQUIPMENT                    |                                       |        |
| =====                                     |                                       |        |
| REAL PROPERTY & IMPROVEMENTS (COST BASIS) |                                       |        |
| 12126.0                                   | 126 HERNDON, RENTAL, SINGLE FAM RESID | DEBIT  |
| 12126.1                                   | ADDITIONS (RETIREMENTS)               | DEBIT  |
| 12514.0                                   | 514 SOUTHFIELD - OUR HOME             | DEBIT  |
| 12514.0                                   | ADDITIONS (RETIREMENTS)               | DEBIT  |
| 12707.0                                   | 707-713 OLIVE, RENTAL, FOUR-PLEX      | DEBIT  |
| 12707.0                                   | ADDITIONS (RETIREMENTS)               | DEBIT  |
| TOTAL REAL PROPERTY AND IMPROVEMENTS      |                                       | TOTAL  |
| =====                                     |                                       |        |
| FURNITURE AND FIXTURES                    |                                       |        |
| 13126.0                                   | 126 HERNDON F & F (COST BASIS)        | DEBIT  |
| 13514.0                                   | 514 SOUTHFIELD F & F (ESTIMATED)      | DEBIT  |
| 13707.0                                   | 707-713 OLIVE F & F (COST BASIS)      | DEBIT  |
| 13998.0                                   | F & F ADDITIONS (RETIREMENTS)         | DEBIT  |
| TOTAL FURNITURE AND FIXTURES              |                                       | TOTAL  |
| =====                                     |                                       |        |
| EQUIPMENT                                 |                                       |        |
| 14100.0                                   | SHOP EQUIPMENT (COST BASIS)           | DEBIT  |
| 14200.0                                   | OFFICE EQUIPMENT (COST BASIS)         | DEBIT  |
| 14300.0                                   | COMPUTER EQUIPMENT (COST BASIS)       | DEBIT  |
| 14400.0                                   | YARD EQUIPMENT (COST BASIS)           | DEBIT  |
| 14500.0                                   | AUTOMOBILE, PERSONAL, (ESTIMATED)     | DEBIT  |
| 14600.0                                   | AUTO, BUSINESS & PROFESSIONAL (COST)  | DEBIT  |
| 14700.0                                   | TRUCK, PICK-UP (COST BASIS)           | DEBIT  |
| 14998.0                                   | EQUIPMENT ADDITIONS (RETIREMENTS)     | DEBIT  |
| TOTAL EQUIPMENT                           |                                       | TOTAL  |
| TOTAL PROPERTY AND EQUIPMENT              |                                       | TOTAL  |
| =====                                     |                                       |        |
| 16000.0                                   | REMODELING IN PROCESS                 | DEBIT  |
| =====                                     |                                       |        |
| ACCUMULATED DEPRECIATION                  |                                       |        |
| =====                                     |                                       |        |
| BUILDING AND IMPROVEMENT DEPRECIATION     |                                       |        |
| 17126.0                                   | 126 HERNDON BLDG & IMPROV DEPREC      | CREDIT |
| 17126.1                                   | ADDITIONS (RETIREMENTS) DEPREC        | CREDIT |
| 17514.0                                   | 514 SOUTHFIELD BLDG & IMPROV DEPREC   | CREDIT |
| 17514.1                                   | ADDITIONS (RETIREMENTS) DEPREC        | CREDIT |
| 17707.0                                   | 707-713 OLIVE BLDG & IMPROV DEPREC    | CREDIT |
| 17707.1                                   | ADDITIONS (RETIREMENTS) DEPREC        | CREDIT |
| TOTAL BLDG & IMPROV DEPRECIATION          |                                       | TOTAL  |
| =====                                     |                                       |        |
| FURNITURE AND FIXTURES DEPRECIATION       |                                       |        |
| 18020.0                                   | F & F DEPRECIATION, HOME              | CREDIT |
| 18030.0                                   | F & F DEPRECIATION, RENTAL PROPERTY   | CREDIT |
| 18040.0                                   | F & F ADDITIONS (RETIREMENTS)         | CREDIT |
| TOTAL FURN & FIXT DEPRECIATION            |                                       | TOTAL  |

## EQUIPMENT DEPRECIATION

|                                     |                                       |            |
|-------------------------------------|---------------------------------------|------------|
| 18050.0                             | SHOP EQUIPMENT DEPRECIATION           | CREDIT     |
| 18060.0                             | OFFICE EQUIPMENT DEPRECIATION         | CREDIT     |
| 18070.0                             | COMPUTER EQUIPMENT DEPRECIATION       | CREDIT     |
| 18080.0                             | YARD EQUIPMENT DEPRECIATION           | CREDIT     |
| 18090.0                             | PERSONAL AUTO DEPRECIATION            | CREDIT     |
| 18092.0                             | BUSINESS & PROF AUTO DEPRECIATION     | CREDIT     |
| 18094.0                             | PICK-UP TRUCK DEPRECIATION            | CREDIT     |
| 18096.0                             | EQUIPMENT ADDITIONS (RETIREMENTS)     | CREDIT     |
| TOTAL EQUIPMENT DEPRECIATION        |                                       | TOTAL      |
| =====                               |                                       |            |
| TOTAL PROPERTY & EQUIP DEPRECIATION |                                       | TOTAL      |
| =====                               |                                       |            |
| TOTAL PROPERTY & EQUIP, DEPRECIATED |                                       | TOTAL      |
| =====                               |                                       |            |
| 19000.0                             | HUSBAND'S RETIREMENT, PAID IN         | DEBIT      |
| =====                               |                                       |            |
| TOTAL ASSETS                        |                                       | TOTAL      |
| =====                               |                                       |            |
| LIABILITY ACCOUNTS                  |                                       |            |
| =====                               |                                       |            |
| CURRENT LIABILITIES                 |                                       |            |
| =====                               |                                       |            |
| 21100.0                             | SHORT TERM NOTES PAYABLE              | CREDIT     |
| 21300.0                             | ACCOUNTS PAYABLE                      | CREDIT     |
| 21400.0                             | TENANT'S DEPOSITS REFUNDABLE          | CREDIT     |
| 21500.0                             | TAXES PAYABLE                         | CREDIT     |
| TOTAL CURRENT LIABILITIES           |                                       | TOTAL      |
| =====                               |                                       |            |
| LONG TERM LIABILITIES               |                                       |            |
| =====                               |                                       |            |
| NOTES PAYABLE                       |                                       |            |
| 22126.0                             | 126 HERNDON - NOTE                    | CREDIT     |
| 22514.0                             | 514 SOUTHFIELD - NOTE                 | CREDIT     |
| 22707.0                             | 707-713 OLIVE STREET - NOTE           | CREDIT     |
| 22800.0                             | L&K BANK - NOTE                       | CREDIT     |
| 22900.0                             | CENTENARY COLLEGE STUDENT LOAN        | CREDIT     |
| TOTAL LONG TERM LIABILITIES         |                                       | TOTAL      |
| TOTAL LIABILITIES                   |                                       | TOTAL      |
| =====                               |                                       |            |
| OWNER'S EQUITY                      |                                       |            |
| =====                               |                                       |            |
| WIFE'S EQUITY                       |                                       |            |
| =====                               |                                       |            |
| 24100.0                             | L&K CERTIFICATE OF DEPOSIT (COST)     | CREDIT     |
| 24200.0                             | 126 HERNDON AVE - EQUITY              | CREDIT     |
| 24300.0                             | 126 HERNDON FURN & FIXT - EQUITY      | CREDIT     |
| 24400.0                             | PERSONAL AUTOMOBILE (DEPRECIATED)     | CREDIT     |
| 24500.0                             | PAID IN CAPITAL                       | CREDIT     |
| 24600.0                             | RETAINED EARNINGS                     | CREDIT     |
| TOTAL, WIFE'S EQUITY                |                                       | TOTAL      |
| =====                               |                                       |            |
| HUSBAND'S EQUITY                    |                                       |            |
| =====                               |                                       |            |
| 25100.0                             | E.F.HUTTON CO. ACC'T (COST BASIS)     | CREDIT     |
| 25200.0                             | 707-713 OLIVE STREET (DEPRECIATED)    | CREDIT     |
| 25300.0                             | OLIVE ST FURN & FIXT (DEPRECIATED)    | CREDIT     |
| 25400.0                             | EQUIPMENT (COST BASIS, DEPRECIATED)   | CREDIT     |
| 25500.0                             | RETIREMENT FUND, PAID IN              | CREDIT     |
| 25600.0                             | LIFE INSURANCE (CASH SURRENDER VALUE) | CREDIT     |
| 25700.0                             | PAID IN CAPITAL                       | CREDIT     |
| 25800.0                             | RETAINED EARNINGS                     | CREDIT     |
| TOTAL, HUSBAND'S EQUITY             |                                       | TOTAL      |
| =====                               |                                       |            |
| JOINT VENTURE EQUITY                |                                       |            |
| =====                               |                                       |            |
| 26100.0                             | 514 SOUTHFIELD, HOME - JOINT EQUITY   | CREDIT     |
| 26200.0                             | SOUTHFIELD FURN & FIXT (ESTIMATED)    | CREDIT     |
| 26300.0                             | UNDIVIDED RETAINED EARNINGS           | CREDIT     |
| TOTAL JOINT VENTURE EQUITY          |                                       | TOTAL      |
| TOTAL OWNER'S EQUITY                |                                       | TOTAL      |
| =====                               |                                       |            |
| TOTAL LIABILITY & OWNER'S EQUITY    |                                       | TOTAL      |
| =====                               |                                       |            |
| TOTAL, DEBIT ACCOUNTS               |                                       | DEBITS     |
| TOTAL, CREDIT ACCOUNTS              |                                       | - CREDITS  |
| =====                               |                                       |            |
| PROOF                               |                                       | DIFFERENCE |

Continued on next page



## INCOME STATEMENT ACCOUNTS

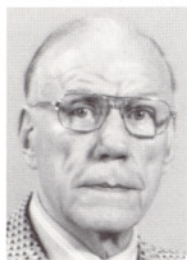
| NUMBER                            | ACCOUNT NAME                         | KIND   | SALES<br>FLAG |  |            |
|-----------------------------------|--------------------------------------|--------|---------------|--|------------|
| INCOME ACCOUNTS                   |                                      |        |               | 41900.0 PERSONAL GIFTS                       | DEBIT      |
| ANNUAL BUDGET ENTRY               |                                      |        |               | 41950.0 DONATIONS (TAX DEDUCTIBLE)           | DEBIT      |
| 30001.0                           | 1/12 OF BUDGETED ANNUAL INCOME       | CREDIT | SALES         | TOTAL PERSONAL EXPENSE                       | TOTAL      |
| 30002.0                           | BUDGETED ANNUAL INCOME OFFSET        | DEBIT  |               | BUSINESS AND PROFESSIONAL EXPENSE            |            |
| EARNED INCOME                     |                                      |        |               | WAGES AND BENEFITS                           |            |
| 31100.0                           | SALE OF SCULPTURE                    | CREDIT |               | 43110.0 JANITORIAL SERVICES                  | DEBIT      |
| 31200.0                           | HUSBAND'S SALARY - GROSS             | CREDIT |               | 43120.0 OTHER DIRECT LABOR                   | DEBIT      |
| 31300.0                           | CONSULTING FEES                      | CREDIT |               | 43130.0 PAYROLL TAXES                        | DEBIT      |
| 31400.0                           | OTHER EARNED INCOME                  | CREDIT |               | TOTAL WAGES AND BENEFITS                     | TOTAL      |
| TOTAL EARNED INCOME               |                                      |        |               | MATERIALS, SUPPLIES AND SERVICES             |            |
| RENTAL INCOME                     |                                      |        |               | 43200.0 SHOP MATERIALS, SUPPLIES & SERVICES  | DEBIT      |
| 32126.0                           | 126 HERNDON AVENUE - RENT            | CREDIT |               | 43210.0 SCULPTURE MATERIALS, SUPPLIES & SVCS | DEBIT      |
| 32707.0                           | 707 OLIVE STREET - RENT              | CREDIT |               | 43220.0 OFFICE MATERIALS, SUPPLIES & SVCS    | DEBIT      |
| 32709.0                           | 709 OLIVE STREET - RENT              | CREDIT |               | 43230.0 OTHER BUS/PROF MATER, SUPPL & SVCS   | DEBIT      |
| 32711.0                           | 711 OLIVE STREET - RENT              | CREDIT |               | TOTAL MATERIALS, SUPPLIES & SERVICES         | TOTAL      |
| 32713.0                           | 713 OLIVE STREET - RENT              | CREDIT |               | 43300.0 EQUIPMENT EXPENSE                    | DEBIT      |
| TOTAL OLIVE STREET GROSS RENTS    |                                      |        |               | TRANSPORTATION EXPENSE                       |            |
| TOTAL GROSS RENTS                 |                                      |        |               | 43400.0 PICK-UP TRUCK - REPAIRS              | DEBIT      |
| OTHER INCOME                      |                                      |        |               | 43410.0 PICK-UP TRUCK - GASOLINE             | DEBIT      |
| 33100.0                           | TRAVEL EXPENSE REIMBURSED            | CREDIT |               | 43420.0 PICK-UP TRUCK - INSURANCE            | DEBIT      |
| 33200.0                           | OTHER EXPENSE REIMBURSED             | CREDIT |               | 43450.0 BUS & PROF AUTO - REPAIRS            | DEBIT      |
| 33300.0                           | MISCELLANEOUS INCOME                 | CREDIT |               | 43460.0 BUS & PROF AUTO - GASOLINE           | DEBIT      |
| TOTAL OTHER INCOME                |                                      |        |               | 43470.0 BUS & PROF AUTO - INSURANCE          | DEBIT      |
| SECURITIES AND SAVINGS INCOME     |                                      |        |               | TOTAL TRANSPORTATION EXPENSE                 | TOTAL      |
| 34100.0                           | INTEREST ON SAVINGS                  | CREDIT |               | 43500.0 CREDIT AND COLLECTION SERVICES       | DEBIT      |
| 34200.0                           | E.F.HUTTON CO. ACC'T - INCOME        | CREDIT |               | 43550.0 OTHER OUTSIDE SERVICES               | DEBIT      |
| 34300.0                           | OTHER SECURITIES - INCOME            | CREDIT |               | 43600.0 BUS & PROF LICENSES & FEES           | DEBIT      |
| TOTAL SECURITIES & SAVINGS INCOME |                                      |        |               | 43700.0 LIABILITY INSURANCE                  | DEBIT      |
| TOTAL INCOME                      |                                      |        |               | 43750.0 WORKMAN'S COMPENSATION INSURANCE     | DEBIT      |
| EXPENSE ACCOUNTS                  |                                      |        |               | 43800.0 BUS & PROF TRAVEL EXPENSE            | DEBIT      |
| PERSONAL EXPENSE ACCOUNTS         |                                      |        |               | 43810.0 BUS & PROF ENTERTAINING EXPENSE      | DEBIT      |
| WAGES AND BENEFITS                |                                      |        |               | 43820.0 BUS & PROF TELEPHONE EXPENSE         | DEBIT      |
| 41110.0                           | MAID SERVICES                        | DEBIT  |               | 43830.0 BUS & PROF POSTAGE EXPENSE           | DEBIT      |
| 41120.0                           | YARD MAN SERVICES                    | DEBIT  |               | 43840.0 BUS & PROF SHARE CLUB DUES           | DEBIT      |
| 41130.0                           | OTHER DIRECT LABOR                   | DEBIT  |               | 43850.0 CHAMBER OF COMMERCE                  | DEBIT      |
| 41140.0                           | PAYROLL TAXES                        | DEBIT  |               | 43860.0 BETTER BUSINESS BUREAU               | DEBIT      |
| TOTAL WAGES AND BENEFITS          |                                      |        |               | 43870.0 OTHER BUS & PROF SOCS. & ASSOCS.     | DEBIT      |
| 41210.0                           | PERSONAL SUPPLIES AND EXPENSE        | DEBIT  |               | 43880.0 BUS & PROF PUBLICATIONS              | DEBIT      |
| 41250.0                           | PERSONAL S & E REFUNDS               | CREDIT |               | 43890.0 MISCELLANEOUS BUS & PROF EXPENSE     | DEBIT      |
| 41260.0                           | POCKET MONEY                         | DEBIT  |               | 43900.0 LOSS (GAIN) ON PROPERTY/EQUIP SALE   | DEBIT      |
| 41300.0                           | PERSONAL AUTOMOBILE REPAIRS          | DEBIT  |               | 43950.0 INTEREST (INCOME) EXPENSE            | DEBIT      |
| 41310.0                           | PERSONAL AUTOMOBILE GASOLINE         | DEBIT  |               | 44000.0 ESTIMATED FEDERAL INCOME TAX W/H     | DEBIT      |
| 41320.0                           | PERSONAL AUTOMOBILE INSURANCE        | DEBIT  |               | 44100.0 ESTIMATED STATE INCOME TAX W/H       | DEBIT      |
| INSURANCE PREMIUMS                |                                      |        |               | RENTAL PROPERTY EXPENSE                      |            |
| 41400.0                           | HOME OWNER'S INSURANCE               | DEBIT  |               | 45126.1 126 HERNDON - REPAIR & MAINTAIN      | DEBIT      |
| 41410.0                           | DISABILITY INSURANCE                 | DEBIT  |               | 45126.2 TAXES                                | DEBIT      |
| 41420.0                           | HOSPITALIZATION INSURANCE            | DEBIT  |               | 45126.3 INSURANCE                            | DEBIT      |
| 41430.0                           | LIFE INSURANCE                       | DEBIT  |               | 45126.4 ADVERTISING                          | DEBIT      |
| 41440.0                           | ACCIDENTAL DEATH & DISMEMBERMENT INS | DEBIT  |               | 45126.5 INTEREST PAID ON NOTE                | DEBIT      |
| 41450.0                           | AMBULANCE SERVICE INSURANCE          | DEBIT  |               | 45126.6 UTILITIES                            | DEBIT      |
| 41460.0                           | HCFA MEDICARE INSURANCE              | DEBIT  |               | 45126.7 JANITORIAL SERVICES                  | DEBIT      |
| 41470.0                           | MEDICARE SUPPLEMENT INSURANCE        | DEBIT  |               | TOTAL 126 HERNDON EXPENSE                    | TOTAL      |
| 41480.0                           | MAJOR MEDICAL INSURANCE              | DEBIT  |               | 45707.1 707 OLIVE ST - REPAIR & MAINTAIN     | DEBIT      |
| 41490.0                           | TRAVEL AND AIR TRAVEL INSURANCE      | DEBIT  |               | 45707.2 TAXES                                | DEBIT      |
| 41500.0                           | TAXES, 514 SOUTHFIELD - HOME         | DEBIT  |               | 45707.3 INSURANCE                            | DEBIT      |
| 41600.0                           | PERSONAL TRAVEL EXPENSE              | DEBIT  |               | 45707.4 ADVERTISING                          | DEBIT      |
| 41610.0                           | PERSONAL TELEPHONE EXPENSE           | DEBIT  |               | 45707.5 INTEREST PAID ON NOTE                | DEBIT      |
| 41620.0                           | CLUB DUES, PERSONAL SHARE            | DEBIT  |               | 45707.6 UTILITIES                            | DEBIT      |
| 41630.0                           | PERSONAL ENTERTAINING                | DEBIT  |               | 45707.7 JANITORIAL SERVICES                  | DEBIT      |
| 41640.0                           | PERSONAL PUBLICATIONS                | DEBIT  |               | TOTAL 707-713 OLIVE ST EXPENSE               | TOTAL      |
| 41700.0                           | MEDICAL AND DENTAL EXPENSE           | DEBIT  |               | TOTAL RENTAL PROPERTY EXPENSE                | TOTAL      |
| 41710.0                           | DRUGS                                | DEBIT  |               | TOTAL BUSINESS & PROFESSIONAL EXPENSE        | TOTAL      |
| 41800.0                           | ELECTRICITY BILL                     | DEBIT  |               | TOTAL EXPENSE                                | TOTAL      |
| 41810.0                           | FUEL BILL                            | DEBIT  |               | TOTAL, CREDIT ACCOUNTS                       | CREDITS    |
| 41820.0                           | WATER BILL                           | DEBIT  |               | TOTAL, DEBIT ACCOUNTS                        | - DEBITS   |
|                                   |                                      |        |               | RETAINED EARNINGS                            | DIFFERENCE |



## Technical Addendum

The hardware upon which the author installed the Osborne General Ledger is a Cromemco System III. This consists of the central processing unit (Cromemco Z-80 CPU), four, sixteen-kilobyte memory boards (Cromemco 16kz RAM) for a total of sixty-four kilobytes of memory, a disk control board (Cromemco 4FDC), a printer control board (Cromemco PRI), a Cromemco 3100 terminal (OEM Beehive B100), two, single-density, single-sided disk drives (OEM PERSCI), and the Cromemco 3703 printer (OEM Centronics 703).

The software consists of CP/M version 1.4 for Cromemco (digital research), CBASIC2 compiler, version 2.06, with CRUN2, version 2.06. (Graham-Dorian) and general ledger for CBASIC-2 (Osborne/McGraw-Hill).



### About the Author

George Meneely graduated from Princeton University with high honors in Biology and from Cornell University Medical College in the upper third of his class. After four years of internal medicine at the University of Rochester, he went to Louisiana State University School of Medicine in New Orleans, and thence to the Vanderbilt University Medical Faculty for twenty years. A brief period in Chicago at the AMA and Northwestern University led him to the University of Texas Graduate School of Biomedical Science at Houston and the M.D. Anderson Hospital and Tumor Institute where he also worked part-time at the IBM Scientific Center. He returned to LSU to start a new medical school at Shreveport. He is professor of Medicine and of Physiology and Biophysics, and directs the Planning Office. There he has a terminal to a DEC PDP 11/40, and in his office at home, a Cromemco System III. He has published over two hundred articles and several books. Honors include: Distinguished Fellow, American College of Nuclear Medicine, Past President, American College of Cardiology. He is active in numerous other scientific societies.

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Full service company, providing consultation. Stocks a large inventory of both hardware and software; specializes in payrolls, power generation monitor, custom device drivers. Provides warranty repair service.

Key Personnel: William Hutchison, Owner  
R. Pereira, software specialist  
R. Yorgenson, software specialist

Major Market Area:  
Sales & Service: Throughout Alaska

## AGRO MARKETING

B. Adzije 7/1, 41000 Zagreb  
Yugoslavia  
41 417-662 Telex: 2141yuam

Large full-service facility, with complete line of Cromemco products and proprietary software. Specializing in software development, interfacing, and special medical computerized equipment.

Key Personnel: T. Raguz, Director (Marketing)  
N. Ivancic, Software Manager  
B. Krtolica, Customer Support (Hardware)

Major Market Area:  
Sales & Service: Internationally, primarily Yugoslavia

## AMERICAN COMPUTERS & ENGINEERS, INC.

2001 S. Barrington, Suite 204  
Los Angeles, CA 90025  
(213) 477-6751

Consulting engineers, sales and service. Provides on site or in-house service agreements to all Cromemco Users. Offers structural engineering programs, accounting and word processing.

Key Personnel: Ghassan Dib, Pres. (Ph.D. Structural Engineering)  
Aziz Al-Khal, Industrial Engineer,  
(Sales & Marketing)  
Marwan Dib, Mechanical Engineer,  
(General Manager)

Major Market Area:  
Sales & Service: Stores in Berkeley & Los Angeles,  
California and Paris, France.

## COLLINGSWOOD COMPUTER CENTER

2311 W. Route 70  
Cherry Hill, NJ 08002  
(609) 488-1144

Medium-sized software house, specializing in small business systems; all models of Cromemco/payroll, billing, mass mailer. Provides warranty service also contract and hourly service.

Key Personnel: Jim Lenz, Pres. (Software design & development)  
Eric J. Watkins, Sales Representative  
Jim Masterson, Vice Pres. (Service)

Special Memberships are open to authorized Dealers & OEMs only. These memberships cost \$350 per year, and entitle the member to a special listing on the Association's Referral Service Data Base, as well as this printed listing.

Major Market Area:

Sales: New York to Washington, extending to entire U.S.  
Service: Metro Philadelphia extending to Eastern Corridor.

## COMPUTER CENTERS OF AMERICA

|   |   |
|---|---|
| 2129 Westheimer Road<br>Houston, TX 77098<br>(713) 527-8008 | 2629 Stemmons Fwy., 215<br>Dallas, TX 75207<br>(214) 638-4477 |
|---|---|

Complete line of hardware and software in inventory, 10,000 square feet of space. Provides warranty repair service.

Key Personnel: Avery More, Pres. (sales)  
Richard Hernlund, Dallas Manager  
Ron Blake, Houston Manager

Major Market Area: Sales & Service: Houston and Dallas, Texas.

## COMPUTERLAND

16 A Avenue Marnix  
1050 Brussels  
Belgium  
2/54.34.45 Telex: 62973

Computer store, providing warranty repair service. Complete line of Cromemco equipment.

Key Personnel: T. Beyerman, Chairman (software)  
J.P. Deville, Technician (hardware)

Major Market Area:  
Sales & Service: Internationally, primarily Belgium

## COMPUTER PRODUCTS INTERNATIONAL

3225 Danny Pkwy.  
Metairie, LA 70002  
(504) 455-5330

Software house, specializing in general business and wholesale distributor systems. Full line of Cromemcos, in 10,000 sq. ft. two story building.

Key Personnel: Dan Ellis, Pres.  
Jim Miller, Vice Pres. (systems)  
Ben Rauch, Vice Pres. (systems)

Major Market Area: Sales: Entire Gulf Coast. Extended area, U.S.

## CUSTOM COMPUTER SPECIALISTS, INC.

208 Roanoke Avenue  
Riverhead, NY 11952  
(516) 369-2199

Full service systems house with retail showroom. Full line of Cromemco hardware, software, accessories, and literature. Provides warranty service, diagnostics, consultation, systems analysis, and custom programming. Special management software for attorneys, mass transportation scheduling, reservations, delivery manifests, education, small businesses. School rentals, teacher training.

Key Personnel: Gregory G. Galdi, Pres.



Major Market Area: Sales: Northeast U.S., extending to East Coast.  
Service: East Coast extending to Continental U.S.

**DATA DE MEXICO SA**  
**Saturnino Herran 77**  
**Mexico 19, D F.**  
**593-22-42**

Computer store, with showroom displaying complete line of Cromemco equipment. Special emphasis on small businesses and in the educational field. Warranty repair service available.

Key Personnel: Ignacio Palomar, Gen. Mgr. (hardware)  
Jose H. Espinosa, Program Mgr. (software)

Major Market Area:  
Sales & Service: Internationally, primarily Mexico

**DATRON MICRO-CENTRE**  
**2 Abbydale Road**  
**Sheffield, England**  
**0742-585490 / Telex: 547-151**

Main importer, sales and support to dealers and direct, Europe wide. Full Cromemco range. Standard software & consultancy for special applications. Experienced in customized hardware and device drivers and provides warranty and duration service.

Key Personnel: Ian Dunkley, Director (sales)  
Dave Rotherham, Software Specialist  
Dlan Deeley, Hardware and Configuration  
Paul Waring, Civil Engineer

Major Market Area: United Kingdom, Europe

**DIGIBYTE SYSTEMS CORP.**  
**31 East 31st Street**  
**New York, NY 10016**  
**(212) 889-8130**

Computer store carrying a full line of Cromemco hardware and software. Warranty service is provided.

Key Personnel: Robert Silverman, Pres. (software)  
Barry Becker, Vice Pres. (hardware)

Major Market Area:  
Sales & Service: Primarily East Coast

**DIGITAL TECHNOLOGY**  
**10 North Third**  
**Lafayette, IN 47901**  
**(317) 423-2548**

3,000 sq. ft. computer showroom, specializing in educational/business systems. Large inventory of Cromemco software. Warranty repair service available.

Key Personnel: Greg Madden, Proprietor (hardware)  
Tim Stockman (software)

Major Market Area:  
Sales & Service: Indiana, throughout Midwest

**DIGITRONIC**  
**Digitronic Computersystems GmbH**  
**Am Kamp 17 .2081 Holm**  
**Holstein, West Germany**  
**0 41 03 / 8 86 72 / 3 Telex: 02 189 561**

Full service computer store, providing consultation and warranty repair service. Complete inventory of Cromemco boards, systems, software packages.

Key Personnel: Claus Martens  
Holger Vorbeck  
Peter Adebahr

Major Market Area:  
Sales & Service: West Germany

**DIGITUS LIMITED**  
**9 Macklin Street**  
**Coven Garden, London WC2**  
**01-4056761 Telex - Ref: 3005**

Complete line of Cromemco hardware and software, 4,000 sq. ft. of space. Specializing in training, management sciences, personnel systems. Provides consultation services.

Key Personnel: A.C. Wood, Managing Dir. (consultancy)  
P.S. Woolfonden, Systems Mgr. (software)  
S. Parel, Sales Mgr. (hardware)

Major Market Area: Sales & Service: London, extending throughout United Kingdom.

**INFORMATIVE SYSTEMS P/L**  
**3 Bank Street**  
**South Melbourne, Victoria, Australia**  
**03-6902284 TWX 30458**

Full range of Cromemco, retail and wholesale computer store. Provides full sales and service, specializing in education and small business applications.

Key Personnel: Dr. Simon Rosenbaum, Mng. Dir.  
Ian Savicky, Tech. Advisor  
Norman Rosenbaum, Sales Mgr.  
Mark Coulthard, Engineer

Major Market Area: Sales & Service: Throughout Australia

**INFOSOFT SYSTEMS, INC.**  
**25 Sylvan Road South**  
**Westport, CT 06880**  
**(203) 226-8937**

Supplier of sophisticated software to systems users and retailers. Complete line of Cromemco software and applications packages in stock, as well as hardware. Special interconnects to accommodate Cromemco software.

Key Personnel: Ken Short, Pres. (sr. programmer/analyst)  
Richard Roth, Vice Pres. Mktg. & Production  
Peggy Herlihy, Customer Service (analyst)

Major Market Area: Sales: International. Service: U.S.

**LENDAC DATA SYSTEMS, LTD.**  
**8 Dawson Street**  
**Dublin 2, Ireland**

Suppliers and supporters of the full range of Cromemco Computer Systems and software.

Key Personnel: Danny McNally, Director

Major Market Area:  
Sales & Service: Throughout Ireland

*Continued on next page*



**LEAR DATA CORPORATION**  
3273 Claremont Way, Suite 203  
Napa, CA 94558  
(707) 252-7139

Systems House and full Cromemco dealership in professional, 3,000 square foot office facilities. Separate lab and repair facilities. 24-hour service responses. Provides full warranty service. Drive alignments done in-house.

Key Personnel: Robert Gustafson, Pres.  
Dr. Joseph Nelson, Vice Pres.  
Doug Sherrod, V.P./Mktg.

Major Market Area: Software - Nationwide  
Hardware - Northern Calif.

**MCM ENTERPRISES**  
459 Hamilton Ave., No. 304  
Palo Alto, CA 94304  
(415) 493-3333

A full service computer solutions company with consulting, equipment, software, training, and service. MCM carries a full line of Cromemco Systems, Lear Tristar and Serendipity Business Software, and NEC Service Center for Northern California (printers and & printing terminals).

Key Personnel: M.C. Merchant, (MSEE) Owner  
C. Leighton, Project Manager  
G. Nielsen, Service Engineer  
S. Evans, (CPA) Bus. Consultant  
J. Peckler, (CPA) Bus. Consultant  
L. Terry, Acctg. Sys. Consultant  
L. Yori, (BSEE) Mgr. Reno Office  
M. Nadaire, (MSEE) Mgr. Paris Office

Major Market Area:

Sales: San Francisco Peninsula & Nevada extending internationally.

Service: S.F. Peninsula & Nevada extending into N. California

Reno Office: 1275 Kleppe Lane, No. 14  
Sparks, NV 89431  
(702) 358-0415

Paris Office: 4 Rue Paul Bert  
92150 Suresnes, France  
Tel (1) 506 33 03 TLX 610994F

**MICAH (Micro Applications & Hardware)**  
919 Sir Francis Drake Blvd.  
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(415) 459-4003

Software development, consulting & sales. Specializing in Morrow Design Hard Disk Drives interfaced to Cromemco Computers running CP/M, MP/M or CDOS. Our EXPAND program allows CDOS to run under CP/M or MP/M.

Key Personnel: Jerome Freedman, Pres. (Software Engineer)  
Steven Elias, Sales Manager

Major Market Area: International

**MICROCENTRE LIMITED**  
30 Dundas Street  
Edinburgh EH3 6JN Scotland  
031-556 7354 Telex: 72165 Ref. W582

Complete line of Cromemco Catalog items in inventory. 8,000 sq. ft. computer warehouse, extensive workshop for testing of equipment. Warranty repair service is available.

Key Personnel: Norman Rouxel, B.Sc., Director  
(Cromemco equipment)  
Andrew Smith, B.Sc., Director  
(Cromemco equipment)  
John Pringle, B.Sc., Director (Business)

Major Market Area: Sales & Service: Entire United Kingdom, extending to North Sea Basin/Ireland

**SOPORTE ADMINISTRATIVO COMPUTACIONAL, S.A.**  
15 De Mayo #1111 PTE  
Monterrey, N.L. Mexico  
43-83-40

Complete line of Cromemco hardware and software in inventory. Specializing in the educational field. Full service facility, providing technical consulting, as well as warranty repair service.

Key Personnel: Juan Angel Perez, Director (systems)  
Jaime Martinez, Customer Support (MSEE)  
Gerardo Elizondo, Technical Mgr. (MSEE)

Major Market Area:

Sales & Service: Internationally, primarily Mexico

**SYNERGISTICS INTERNATIONAL LTD.**  
35 Fountain Square Plaza, Box 631  
Elgin, IL 60120  
(312) 695-7775

Computer store and software house, with complete line of Cromemco equipment in inventory. Specializing in sales to small business turnkey systems.

Key Personnel: Jim Knowles, Pres. (Sales)  
Gordon Muirhead, Vice Pres. (software)

Major Market Area: Sales: Chicago and suburbs, extending to entire U.S. and the United Kingdom. Service: Chicago and suburbs.

**TRADEWIND SYSTEMS**  
Box 96  
Liberal, KS 67901  
(316) 624-8111, O/S KS 1-800-835-2057

Exclusive Cromemco dealer, specializing in complete business systems. Provides consulting services. Full inventory.

Key Personnel: Clark Stewart, Pres. (business systems)  
Wayne Stewart, Vice Pres. (tech./software)  
Kevin Elmore, Programmer/analysis

Major Market Area: Sales: S.W. Kansas, extending to Colorado, Kansas, Oklahoma, Texas, New Mexico. Service: S.W. Kansas.

**XITAN SYSTEMS, LTD.**  
23 Cumberland Place  
Southampton, England  
0703 38740

Complete line of computers, 1,000 sq. ft. Also add-ons for Cromemco. All Cromemco software included in inventory. Provides warranty repair service.

Key Personnel: G.C. Lynch, Managing Dir. (sales & technical support)  
R. Wilmott, Product Support Engineer (engineering)  
J. Rosser, Personal Assistant (order processing)

Major Market Area: Providing U.K. & E.E.C. with total business, educational scientific, medical and industrial support.



# ATTENTION

WordStar Users

or

## Potential WordStar Users

We would like to bring to your attention our special customization program, allowing you to customize WordStar which will take advantage of 36 function keys, plus the 4 cursor control keys on the Cromemco 3102 CRT Terminal.

WordStar is a very comprehensive word processing software package. Combined with the ease of use and elimination of the required control command codes, the customized version of WordStar is made even more powerful.

The appropriate modifications which we developed for WordStar are automatically applied by running our customization program. Our special customization program uses as input the WordStar program module and makes the appropriate mods quickly and easily.

Special Cromix versions are also available. WordStar constantly polls the console for input. This is done via a looping technique which literally ties up the CPU. This method of detecting console input is fine for a single user system, but not for a system offering the multi tasking/user capability of Cromix. Our customization program modifies WordStar so that console input is detected on an interrupt basis thus allowing better CPU utilization by other tasks/users. There are various control command codes that are directly intercepted by Cromix and never seen by WordStar. Our customization program enables WordStar to issue actual Cromix system calls for console input. The result allows those special control command codes to be delivered to WordStar.

The above two very important features are implemented in both the Cromix/3102 Customization package and the Cromix/non-3102 version package.

### WHAT YOU GET

- One single sided, single density, 8-inch or 5¼-inch diskette containing the customization program
- An instruction manual giving you a step by step walk thru on how to produce your customized version of WordStar
- One user's manual describing in easy to understand language, how to use your new customized version of WordStar
- One template to put over the top part of the 3102 keyboard, which will show the new values of all the function keys
- An additional customization program allowing you to modify WordStar so you can use your Cromemco 3355A printer utilizing all of its capabilities

### FEATURES INCORPORATED INTO FUNCTION KEYS

|                           |                          |                            |
|---------------------------|--------------------------|----------------------------|
| Abandon Edit              | Functional Cursor Keys   | Repeat Next Command        |
| Bold Face (Start/End)     | Help Menu                | Save Edit                  |
| Center Text               | Insert File at Cursor    | Save Edit & Return         |
| Copy Block                | Insert Mode (on/off)     | Screen Format Command Menu |
| Delete Block              | Interrupt                | Scroll Screen Down         |
| Delete Character          | Jump to Beginning of Doc | Scroll Screen Up           |
| Delete Character Left     | Jump to End of Document  | Start Block Marker (set)   |
| Delete Line               | Line Spacing (set)       | Strike Out (Start/End)     |
| Edit control Command Menu | Move Block               | Superscript (Start/End)    |
| End Block Marker (set)    | Printer Page Eject       | TAB Key                    |
| End of Line Clear (EOL)   | Print a Document         | Underline (Start/End)      |
| Find & Replace            | Reform Paragraph         | Write Block Out            |
| Find & Replace Again      |                          |                            |

### WHAT IT COSTS

Customization Program Package (includes all items described above) to produce:

|  |       |
|--|-------|
| • WordStar running under CDOS/3102 Customization   | \$195 |
| • WordStar running under Cromix/3102 Customization | 295   |
| • WordStar running under Cromix/non-3102 version   | 295   |

### Combination Packages

|   |     |
|---|-----|
| • Purchase of WordStar with CDOS/3102 Customization   | 595 |
| • Purchase of WordStar with Cromix/3102 Customization | 695 |
| • Purchase of WordStar with Cromix/non-3102 version   | 695 |

The above three combination packages do not include the Mailmerge option which is \$150 additional.

### WHERE YOU CAN GET IT

Call or write  
Dealer inquiries invited



## ADC ASSOCIATES

960 SAN ANTONIO ROAD  
PALO ALTO, CA 94303 • (415) 493-5500

Customization Template



# Command File Library

By Ford J. Buckner

Ever run out of directory space when there is still room on the diskette for data? This problem occurred to me because of the many command files I have on my resident diskette. Upon reading the article about active command files (The CDOS Active Command File, Vol. 1, No. 1, I/O News), an idea presented itself: Why not create a procedure library where all command files are stored? Then, with a program started from a command file, the command file desired can be extracted from the library. I reasoned that I would be able to store default values for the symbolic parameters, accomplished when the command file is inserted into the library.

In analyzing the problem, I found that the ratio of storage space on a diskette to directory entries is correct for normal applications, but during the setup of customer data-sets, I found I was wasting valuable diskette space, thus forcing the customer to make many diskette changes during the normal processing. So, I set the customer up with command files for all the possible conditions under which he will want to process. This led to a situation whereby I had upwards of 200 command files, a number which exceeds the dataset label convention. Therefore, I created a system called PROCEDURE LIBRARY HANDLER which would allow one data-set on the diskette with three programs: Update, Directory, and Retrieval. This structure occupies an average of 12 directory extent areas, but allows me to have 200 command files available.

## FILE ORGANIZATION

The PROCEDURE LIBRARY records are 96 bytes long, and the file organization is relative. The records are stored with an abundance of pointers to allow access by many different methods, and allow the following features:

- Data Record Compression
- Binary Tree Search for Directory Maintenance
- Deleted Record Space Reusability
- Forward Sequence Record Retrieval
- Reverse Sequence Record Retrieval

## DATA COMPRESSION

Data compression is incorporated in the file in order to ensure maximum utilization of diskette space, necessary since the normal command file occupies 1K of diskette space in CDOS. Utilizing data compression, the minimum amount of diskette storage needed is 184 bytes. This means that five command files can now fit in the space formally occupied by just one. We also save four directory entries.

What is data compression and how does it work? Basically, it is a means whereby redundant characters are stored in a compressed format of 1) compression character, 2) byte count, and 3) character, as illustrated in Figure 1.

Figure 1. Format of Compression String

| Byte 1                          | Byte 2                                   | Byte 3    |
|---------------------------------|--|-----------|
| Compression Character<br>82 HEX | Length in Binary of Redundant Characters | Character |

The only time data compression is invoked is when there are four or more characters the same in sequence. Since CDOS does not return to the application program the carriage return and line-feed delimiter, I have inserted my own delimiter to indicate end-of-record, and a delimiter to indicate end-of-file. (Figure 1A)

Figure 1A. Table of Delimiters Used

| Delimiters            |        |
|-----------------------|--------|
| Compression Indicator | 82 HEX |
| End-of-line           | 80 HEX |
| End-of-file           | 81 HEX |

Perhaps the best way to explain the redundant character compression is by example:

Given a file of COBOL source statements where the records can be from 1 thru 80 bytes long:

1 2 3 ... 8  
123456789012345678901234567890123...0



Identification Division  
Program-ID. AAAAAA.

Looking at this in compressed format, I will show the output record as XXH for the binary values of a character, with a space between each:

82H 07H SP I D E N T I F I C A T I O N SP D I V I S I O N .  
82H 31H SP 80H 82H 07H SP P R O G R A M - I D . SP 82H  
06H A . 82H 36H SP 80H 81H

Thus, we have a string of data which we place in the input record that is 55 bytes long, whereas the input stream was stored on disk as 165 bytes. This example used a COBOL source. The same holds true for command files.

## RECORD STRUCTURES

Records are randomly placed in the file as space is found through the use of the deleted pool pointers and the last record written pointer. The deleted pool pointers are stored in the next available record (first record in file) as shown in Figure 2.

Figure 2. Next Available Record Format (Partial)

|   |  |  |
|---|--|--|
| First deleted record relative record number | Last deleted record relative record number | Last record written relative record number |
|---|--|--|

By fetching the first deleted record number from the next available record, we have a record that contains either 99999 or the next deleted record. (Figure 2A.)

Figure 2A. Deleted Record

|                                |  |
|--------------------------------|--|
| Current relative record number | Next deleted record relative record number |
|--------------------------------|--|

In either case, we move the next deleted record field to first deleted record number in the next available record. Now we can use the deleted record for placing the current record data to the diskette.

We can continue repeating this process until the first deleted record number is 99999. At that point, we must go back to using the last record written and add records to the file.

Now when a command member is deleted, the records are added to the link list of the deleted records. (We must do this since CDOS does not release the space for a deleted record completely.)

Using this approach, we are able to maintain a very tight data file with the least amount of dead record space. Also, the relative record numbers can never be used up and we can, therefore, use a four-digit number instead of having to think of using five digits. (Figure 2B is an example of the deleted record link list.)

Figure 2b. Example of Deleted Record Tree

| Next Available Record                       |  |
|---|--|
| First deleted record relative record number | Last deleted record relative record number |
| 0123  | 0015                                       |

## Deleted Records

|                                |  |
|--------------------------------|--|
| Current relative record number | Next deleted record relative record number |
| 0123                           | 0255                                       |
| 0255                           | 0377                                       |
| 0377                           | 0015                                       |

How is the command member linked in this file? Well, we start back at the next available record. There is another pointer that points to the first directory entry (Figure 2C).

Figure 2C. Next Available Record With Binary Tree

|  |                                   |
|--|-----------------------------------|
| First directory entry relative record number | Other relative record information |
|--|-----------------------------------|

At file initialization time, we set this first directory entry to high-values.

Looking at Figure 3, we see that the directory entry has three pointers: the first record pointer, the last record pointer, and the default record pointer.

Figure 3. Directory Entry (Partial)

|   |  |  |
|---|--|--|
| First record pointer relative record number | Last record pointer relative record number | Default pointer relative record number |
|---|--|--|

The first record pointer is a forward chain thru the detail entries which allows us to access the file and return the member lines in forward, or normal sequence. The second record pointer is the reverse chain thru which the detail entries are returned 'last-record-first' thru 'first-record-last' (the sequence the active command file expects). The default record pointer is used to point to the default symbolic record entry where the default values for the symbolic parameters are stored. Looking at the detail command entries, we see that there are two pointers in each record: the next record pointer, and the previous record pointer (Figure 3A).

Figure 3A. Detail Command Entry (Partial)

|                                |  |  |
|--------------------------------|--|--|
| Current relative record number | Next record pointer relative record number | Previous Record pointer relative record number |
|--------------------------------|--|--|

The next record pointer is used for the forward chain, and the last entry contains 9999 to indicate end-of-chain. The previous record pointer is used for the reverse chain and, since we are starting with the last record first, the first record will contain 9999 to in-

Continued on next page



dicating the end-of-chain. Figure 3B is an example of a command member showing the record linkages.

Figure 3B. Example of Member Link  
(Portions of records only)

Next Available Record

|  |
|--|
| First directory entry relative record number |
| 0031   |

Directory Entry Record

| Current relative record number | First record pointer relative record number | Last record pointer relative record number | Default pointer relative record number |
|--------------------------------|---|--|--|
| 0031                           | 0025  | 0030                                       | 0032                                   |

Default Parameter Record

| Current relative record number | Default parameters |
|--------------------------------|--------------------|
| 0032                           | Noname B           |

Detail Command Records

| Current relative record number | Next record pointer relative record number | Previous record pointer relative record number | Image                          |
|--------------------------------|--|--|--------------------------------|
| 0025                           | 0026                                       | 9999   | A:                             |
| 0026                           | 0027                                       | 0026   | A: DIR                         |
| 0027                           | 0028                                       | 0027   | A: DIR B:                      |
| 0028                           | 0029                                       | 0028   | A: DIR C:                      |
| 0029                           | 0030                                       | 0029   | A: DIR D:                      |
| 0030                           | 9999                                       | 0030   | A: COBOL ^2: ^1, TTY: = ^2: ^1 |

## BINARY TREE SEARCH

The directory entries are tied together by a set of pointers that allow for access to and update of the file in a binary tree approach. Figure 4 shows the pointer relationships between directory entries:

Figure 4. Directory Entry (Partial)

| Key value | Lower key relative record number | Higher key relative record number | Parent relative record number |
|-----------|----------------------------------|-----------------------------------|-------------------------------|
|-----------|----------------------------------|-----------------------------------|-------------------------------|

Each directory entry has three pointers: low, high, and parent. The parent points to the directory entry that called the current record, and is used to return up the tree when doing a directory rebuild. The low pointer points to a directory entry with a key value less than the current key value, while the high pointer points to a directory entry with a key value greater than the current key value.

The last, or not-used pointers contain 9999 to indicate end-of-link. The binary tree is more clearly seen in Figure 4A.

Figure 4A. Example of Binary Tree  
as used with Directory Members

Next Available Record

|  |
|--|
| First Directory Entry Relative Record Number |
| 0031   |

## Directory Entry Record

| Current relative record No. | Lower key relative record No. | Higher key relative record No. | Parent relative record No. | Key value   |
|-----------------------------|-------------------------------|--------------------------------|----------------------------|-------------|
| 0031                        | 0045                          | 9999                           | 9999                       | High-values |
| 0045                        | 0050                          | 0055                           | 0031                       | COBOL       |
| 0050                        | 0010                          | 9999                           | 0045                       | COB         |
| 0010                        | 9999                          | 9999                           | 0050                       | ABC         |
| 0055                        | 0070                          | 9999                           | 0045                       | DIRECT      |
| 0070                        | 9999                          | 9999                           | 0055                       | DIR         |

## MASTER DIRECTORY POINTER

The master directory pointer approach allows for rapid sequential access to members in ascending sequence, necessary for various support functions required. In Figure 5, we see that the next available record has a pointer to the first master directory entry:

Figure 5. Next Available Record (Partial)

|   |
|---|
| First master Directory pointer Relative Record Number |
|---|

The master directory entry has a pointer to the next master directory entry, then ending in 9999 (Figure 5A).

Figure 5A. Master Directory Entry

| Current relative record number | Next master directory relative record number | Directory relative record numbers (occurs 21 times) |
|--------------------------------|--|---|
|--------------------------------|--|---|

Each master directory entry contains 21 pointers to directory entries, each in sequence by key value of directory entry. Thus, by using this table of pointers, we can quickly produce a directory name listing of members on the CRT. Using the values from Figure 4A, we now have an example of the master directory pointers. (Figure 5B).

Figure 5B. Example of Master Directory

Next Available Record

|   |
|---|
| First master directory pointer relative record number |
| 0004  |

Master Directory Entry Record

| Current relative record number | Next master directory relative record number | Directory relative record numbers (occurs 21 times) |
|--------------------------------|--|---|
| 0004                           | 9999   | 0010 0050 0045 0070 0055 9999                       |



## HOW TO USE THE PROCEDURE LIBRARY

It is easiest to show the execution process of the procedure library by use of examples. For instance, we have a command called COBOL in the procedure library which has the following default parameters:

^1=NONAME , ^2=B: Where ^1 is the COBOL name we want to compile, and ^2 is the drive assignment of the COBOL compiler:

```
A.@
CROMEMCO BATCH VERSION 1.04
IEXEC COBOL 1 = ABC
I
A:EXEC COBOL 1 = ABC
B:
B:COBOL A:ABC, TTY: = A:ABC
CROMEMCO COBOL-80 V3. 22.. ABC  COB
1  IDENTIFICATION DIVISION.
2  PROGRAM-ID. ABC.
3  *REMARKS.
```

The command file in the procedure library looks like this:

```
^2:
^2:COBOL ^1, TTY: = ^1
```

The active command file starts processing and begins execution of EXEC (my name for the PROCEDURE LIBRARY RETRIEVAL PROGRAM). It searches the library for command member COBOL, and, when it finds it, EXEC stores the default parameters. It then replaces the necessary ones with the overrides from the command string. The PROGRAM EXEC then returns to the active command file — in reverse string sequence — all the command lines, substituting the necessary symbolic parameters and lengthening the line length count as appropriate.

When the last command line has been returned, the PROGRAM EXEC ends execution, and control is returned to the active command file where the last record written by the program exec will be executed first.

Now if there is another invoke of the PROGRAM EXEC in the active command file — either from a retrieved command member, or inputted through batch — it will be acted up as it is detected. Thus, nesting is permitted. There is no check for recursive nesting, so the user must be careful not to form an infinite loop.

Trying to remember the names of all the commands in the procedure library is difficult, so I have written the program called EXECDIR. This program offers a six-across CRT display, alphabetically listed, of all member names in the procedure library (Figure 6).

Figure 6. Screen Display Directory of Procedure Library

| PROCEDURE LIBRARY<br>DIRECTORY |     |       |     |        |
|--------------------------------|-----|-------|-----|--------|
| ABC                            | COB | COBOL | DIR | DIRECT |

This program helped, but it did not fulfill all needs, so I also wrote a program called EXECLST (Figure 7).

Figure 7. Procedure Library Member Listing

| PROCEDURE LIBRARY MEMBER LISTING   |         |
|--|---------|
| MEMBER ( COBOL )   |         |
| ***** DEFAULT SYMBOLIC PARAMETERS *****  |         |
| 1. =   | NO NAME |
| 2. =   |         |
| 3. =   |         |
| 4. =   |         |
| 5. =   |         |
| 6. =   |         |
| 7. =   |         |
| 8. =   |         |
| 9. =   |         |
| <div style="border: 1px dashed black; padding: 5px; text-align: center;">           COBOL COMPILE COMMAND FILE<br/>           1 = Source program to be compiled         </div> |         |
| C:   |         |
| COBOL B:^1,TTY: = B:^1   |         |
| A:   |         |

Between the two programs, I have all the backup material necessary for complete utilization of the system.

Another feature is included in the procedure library system which allows command lines to be started with an asterisk. The line that starts with an asterisk is a comment line for the procedure library only, and is not passed to the active command file. This provides a method of documentation for the command members. Since I can use CONTROL-P to route the listing of a command member to the printer, I have a master book of commands and all the symbolic parameters are documented.

## AVAILABLE TO IACU MEMBERS

There are programs to initialize the library, to create a sequential data-set of a member, to update the library, and to backup/restore the library.

I am willing to share this system with other members of the IACU for their own use for copying charges only. Since the programs are comprehensive and lengthy, they require two, 8", single-sided, single-density diskettes to transfer the source code, relative files, and com files. The system is written in COBOL with two assembler subroutines. One of the subroutines is USERDRV for CRT specialization, and the other is for command line entry to a COBOL program.

If desired, I will specialize the system for you if you do not have a COBOL compiler, as the system is terminal dependent and I have the various terminal drivers that must be linked into the programs.

(Editor's note: Members interested in taking advantage of Mr. Buckner's generous offer may send their requests to us for forwarding to him.)

## About the Author

Ford J. Buckner is Vice President of Crouse Associates, Inc. of Ann Arbor, Michigan. The firm specializes in public utilities, serving clients throughout the United States. Mr. Buckner was graduated with honors from the Electronic Engineering Program at Electronics Institute in Detroit, Michigan. He has been involved with microprocessor-based systems since 1977.



# Computers in the Psychology Laboratory

By Michael R.J. Dewson, Ph.D.

It should come as no surprise to readers of *I/O News* that microprocessor technology is finding applications in every corner of our lives. It may come as a bit of a surprise, however, to learn that psychologists are employing microprocessors in ever increasing numbers. It is probably safe to say that one would be hard-pressed to find a reputable department of psychology in a North American university which did not have one or more squinty-eyed psychologists peering into a CRT or wiring up strange apparatus to computer interface boards.

To the uninitiated (to psychology, that is), let me first point out that the use of programming, data collection, and data analysis equipment in the laboratories of experimental psychologists has always been quite extensive. Historically, such equipment has usually consisted of highly specialized control equipment, or electro-mechanical devices which could be reassembled in a modular fashion. Some large laboratories have used computers for some time but in the past these were often well beyond either the fiscal or technical resources of most researchers.

The advent of powerful, easy to use, and reasonably priced microprocessors has created a minor revolution in the design of research laboratories for the study of human and animal behavior. A single computer with a few accessories can now do the work of literally dozens of different specialized and costly research tools.

In our lab at Laurentian, one of the first applications of our Cromemco Z2D was in the control of "Skinner" boxes for albino rats. A bare-bones Skinner box is a small enclosure containing a lever connected to a microswitch, and a food dispenser. A rat is first trained to press the lever to cause the delivery of a food pellet from the dispenser. Training then proceeds to more complex tasks such as shifting the requirements for

memco D+7A (digital/analog) board. The BASIC program to run the schedule is quite simple:

```
10 REM PROGRAM TO CONTROL A SKINNER BOX
20 REM ON A FIXED RATIO SCHEDULE
30 IMODE:N=0
40 INPUT "RATIO ",X
50 REM CHECK TO SEE IF LEVER IS DEPRESSED
60 IF INP(24)<>255 THEN GOTO 60
70 N=N+1
80 REM CHECK TO SEE IF LEVER IS RELEASED
90 IF INP(24)<>254 THEN GOTO 90
100 REM CHECK TO SEE IF REWARD IS DUE
110 IF N<X THEN GOTO 50
120 REM DELIVER COMMAND
130 OUT 24,1
140 T=25*2: REM DELAY FOR DISPENSER
    OPERATION
150 OUT 24,0
160 N=0: GOTO 50
```

This program would be modified for an actual research project so that data such as response rate over time could be stored on disk. One advantage of using a computer to run the Skinner boxes is that programs can be easily written to allow the schedule to be constantly modified as the animal's behavior changes over time. This form of interactive control means that experiments can be made more sophisticated than is normally possible with electro-mechanical control equipment. In addition, it has been our experience that the computer control system is virtually breakdown-free while electro-mechanical equipment typically requires frequent maintenance. One other major advantage of the computer control system is that it allows one setup to run a variety of different studies by simply changing the program.

We have also employed the Z2D for a number of human research projects. In a series of research programs studying human concept learning, subjects were presented problems on the CRT and responded either through push buttons or the terminal keyboard. The problems involved searching for unique digit combinations through trial and error strategies. It was important to provide feedback to the subject as soon as he/she had responded and this could only be accomplished by having a computer to compare elements of the subject's response with the elements of the correct answer. The computer also computed response latency and modified the problems for succeeding trials according to the subject's previous responses. Such a procedure would have been quite beyond the capacities of a human experimenter and would have created a nightmare of wiring with electro-mechanical control systems. An additional advantage of using the computer was that it enabled us to run different groups of subjects under "double-blind" conditions, that is, neither the subject nor the experimenter knew what group the subject was in (only the Z2D knew for



food delivery to a special "schedule" of reward. A simple example of such a schedule is the Fixed Ratio schedule in which the reward is made contingent on the rat pressing the lever a fixed number of times (this is essentially the equivalent of "piecework" for humans). In order for the Z2D to control the Skinner box, the lever and dispenser are connected to a Cro-



sure). This feature was particularly important as we were concerned about experimenter bias in the area of research that we were investigating. The different variables measured in each study were written to a disk file in a format suitable for statistical analysis on the university's large computer. The data we collect on the Z2D is sent to the main computer through a Cromemco TU-ART board.

One interesting application of microcomputers in the study of human behavior is the using of a sorting algorithm to reduce the amount of time required of subjects to produce rank orderings of stimuli through paired comparisons. For example, let's say a researcher is interested in determining how people would rank order a list of 32 adjectives along a dimension of "emotional-ity". In the paired comparison method he would individually present all possible pairs of words from his list and ask the subjects to indicate which word on each pair was the more "emotional" of the two. Clearly this task becomes very onerous when the number of words is large. The number of comparisons is  $N(N-1)/2$ , or 496 in this example. By using an interactive computer one can reduce the number of required comparisons through a sorting algorithm to  $N(\log_2 N)$ , or 160 in this example. Generally, there would be very little error introduced by this method, but there would be an obvious savings in time and subject boredom and fatigue. The following 16K-BASIC program, which is adapted from an article by Whaley (1979), demonstrates the use of the sorting algorithm to order 10 words according to the choices made by the subject.

The example is offered in a Cromemco BASIC string array. (For familiarity with Cromemco BASIC string handling conventions, consult the article by Chris Rook in Volume One, Number Three, *I/O News*.)

```

10 REM  N IS NUMBER OF WORDS.  J IS LENGTH OF
    EACH WORD STRING.
20 N=10 : J=15
30 DIM A$(N*(J-1)),B$(J-1)
40 A$(-1)=" "+A$(-1)
50 N=10
60 FOR I=1 TO N
70  X(I)=I
80  READ B$
100  A$(J*(I-1),-LEN(B$))=B$
110 NEXT I
120 GOSUB 180
130 FOR I=1 TO N
140  @A$(((X(I)-1)*15),-15)
150 NEXT I
160 END
170 REM  SORTING ROUTINE
180 M=N
190 M=INT(M/2)
200 IF M=0 THEN RETURN
210 K=N-M
220 J=1
230 I=J
240 P=I+M
250 REM  SUBJECT INDICATES CHOICE
260 @A$(((X(I)-1)*15),-15),A$(((X(P)-1)*15),-15)
270 INPUT R
280 IF R=1 THEN GOTO 320

```

```

290 J=J+1
300 IF J>K THEN GOTO 190
310 GOTO 230
320 L=X(I) : X(I)=X(P) : X(P)=L : I=I-M
330 IF I<1 THEN GOTO 290
340 GOTO 240
350 DATA "SURPRISED","AFRAID","SAD","FRANTIC"
360 DATA "MALICIOUS","RESIGNED","GLAD","CALM"
370 DATA "LOVING","EXHILARATED"

```

In addition to the time saved in running the experiment, this program can easily be expanded to prepare the data for storage and analysis at a considerable saving in time and effort. We are currently using an enhanced version of this program to compare the power of the sorting method with that of another evaluation procedure called a semantic differential.

The future of microcomputer usage in the psychology lab seems to be headed for continued growth as software is constantly being created which replaces more and more of the traditional apparti employed by psychologists. To mention just a few of the commercially available software packages, one can now purchase programs to study reaction time, concept formation, memory and verbal learning, motor skills, sensation and perception, and some physiological phenomena. The practicing psychologist has not been overlooked either. Microcomputer software is now available with packages for doing complete record keeping of clients, and for the administration and scoring of psychological tests of personality, IQ, aptitude, and other specialized types of evaluation.

The growth of microcomputer applications in psychology is by no means a uniquely North American phenomenon. In fact, British psychologists are really a step ahead of us due to the fact that they have created a national registry of computers, of which one goal is to promote the sharing of software and applications development between universities. Perhaps it's time that we started moving in that direction on this side of the Atlantic.

#### REFERENCE

Whaley, C.P. Collecting paired-comparison data with a sorting algorithm. *Behavioral Research and Instrumentation*, 1979, 11, 147-150.



Dr. Dewson is Chairman of the Department of Psychology at Laurentian University in Sudbury, Ontario, Canada, where he has been a member of the faculty since 1975. His Doctoral degree was awarded by the University of Manitoba, and his thesis was entitled: *Sensory Reinforcement in the Operant Conditioning of Non-ambulatory Profoundly Mentally Retarded Adolescents*. In addition to his duties within the Department of Psychology, Dr. Dewson has been active on other campus committees, prepared several papers for academic and professional conferences, and has taught two short courses on computing. He is bilingual, having taught classes in both French and English.



# bits & bytes, nibbles & tweaks...

## HEATING PROBLEM SOLVED

"We were trying to run four to five terminals under CROMIX in our accounting office. The only trouble was, we were crashing at only three users. The problem: Overheating. The solution: We contacted IACU and were told of a retrofit fan made by Howard Industries that pulled about four times as much air through our System Two as the factory installed unit. The fan, a Cyclohm, model 3-15-3450, purchased from Richey Electronics of Sun Valley, California, took about ten minutes to install, costs less than \$20.00, and has us running full speed with the coolest boards in town. Thanks IACU."

(Editor's note: We will pass the thanks along to the member who told us about this. Thanks, Bill.)

## Program Correction

Ted Johnson, contributor of a fine article on taxes (Estimate Taxes and Save, Vol. I, No. 3) noted an error on our listing and sent us the correct data.

| Line # | Should Read   |
|--------|---|
| 1120   | $N = (D - Q) - 0.6 (A - Q)$                         |
| 1150   | $O = A - (D + 3400 + E) + 0.6 * G$                  |
| 1260   | $F = F - J$   |
| 1265   | Should be added to be the same as present line 1260 |

Thanks Ted.

## MICHIGAN: HOT SPOT FOR NEW USERS' GROUP

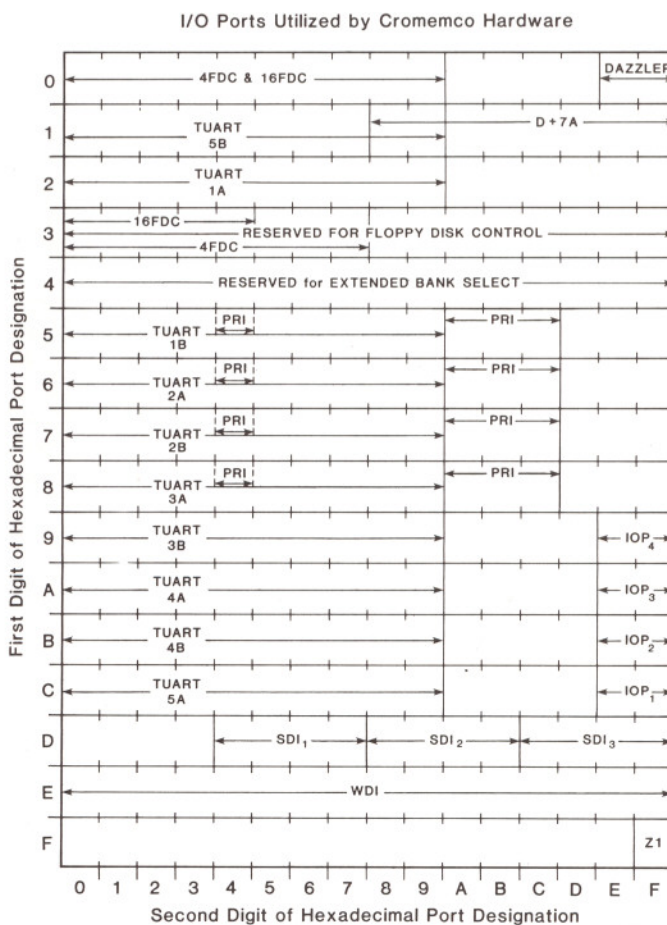
Two members in Michigan are interested in starting local users' groups. Both may be contacted directly, and both are willing to set up the groups. With that kind of enthusiasm, we hope they contact each other first. Frank D. Baber of Warren, MI gave us two phone numbers: (313) 575-4607 (office), and (313) 759-2152 (home). Ford Buckner of Farmington, MI can be reached at either (313) 420-2183, or (313) 478-5213. (A little hint for you gentlemen. When you get your group(s) up and running, try to get Cromemco's President, Dr. Garland, as a guest speaker. He is originally from that neck of the woods, and might like an excuse to visit his old stomping grounds.)

## PORT ASSIGNMENTS... SHOULD BE PROVIDED...

Also from Ford Buckner: "I am looking for the standards on the Port Assignments for the entire Cromemco Line. This information should be provided so Application Programmers can use the various

devices as needed."

Cromemco agreed with you, Ford, and promptly gave us the following:



Incidentally, the above came from page 20 of Cromemco's IOP Instruction Manual. (Reprinted by permission of Cromemco, Inc.)

## INPUT FROM OUTPUT...

In last issue's "output..." we asked members if they could recommend any new software. Professor Donald Runnels of the University of Colorado replied that he had "...three dandies..." to offer:

"Microstat, from Ecosoft (P.O. Box 68602, Indianapolis, IN 46268). This is a very extensive and sophisticated statistics package that runs nicely, without any modifications, under CDOS and Microsoft BASIC. Cost is about \$250 (plus Microsoft BASIC, of course)."



"Microplot, from MICAH (919 Sir Francis Drake Blvd., Kentfield, CA 94904). This package is designed to run directly under CDOS, and to use the 3355A printer as a graphics terminal. It produces beautiful graphs, charts, and diagrams on the 3355A. I have had no trouble at all with it. Cost is \$200."

"Information Master, from Island Cybernetics (P.O. Box 208, Port Aransas, TX 78373). An amazing data storage and retrieval system, designed for storing large masses of text and then recalling the text by key-words. There is virtually no limit on the number of key-words and the size of the text stored. It is ideal for scientists and authors who want to save large amounts of written material, such as articles, abstracts, reports, etc. It is wonderfully versatile, and it runs without any modifications under CDOS, including output to the 3355A. Total cost ... an amazing \$40!!"

Professor Runnels had previously told us about Information Master, and we have a copy on hand provided by Island Cybernetics. We will report our experiences with it as soon as we can.

## REPORT ON WEST L.A. "CROHORTS"

Last issue we indicated we would be attending the organizational meeting of a then unnamed local users' group being formed in West Los Angeles. We (Lynn and I) went to the meeting and were impressed. About a dozen avid Cromemcoites met at the home of Dr. William Cannon (Cannon's wife, Myke, served an excellent buffet) and immediately set up goals for the group. One of the first was the implementation of a course in 32K SBASIC for members of the group. (Unfortunately, time and distance do not allow me to attend regularly, as I need a lot of help to learn programming.) Another item was the naming of the group, the "Crohorts." Perhaps the most impressive things were the interplay among the members — their willingness to help each other solve whatever problems might arise — and the levels of talent exhibited. If this group is at all typical, then I would recommend everyone who can to join, or start a local group. It truly amazed me as to how much information could be exchanged in a single evening.

## SPOKANE, WASHINGTON HOME OF NEW GROUP

As more local users' groups are formed, the momentum seems to build. We received a note from Jay Townsend and Bob McNeel of TLM, Inc. (see software ad, this issue) who want to play host to the development of a group in what is called the Northwest Inland Empire — an area that has Spokane at the hub and encompasses Western Montana, Northern Idaho, and Eastern Washington. If you want a chance to share experiences and gain helpful data, contact Jay or Bob at: TLM, Inc., P.O. Box 644, Spokane, WA 99210. Phone: (509) 838-4397.

## SOUTH JERSEY & PHILLY GROUP GROWING

A brief message from Eric Watkins, the workhorse behind the newly-formed South Jersey & Philly Users' Group, indicates that the group is very active, and rapidly expanding. Eric can be contacted at (609) 488-1144.

## 3102 FIELD REPAIR NOTES

Our good friend, Barry Becker of Computer Center of New York, volunteered the following:

### I.

| SYMPTOM   | CORRECTIVE ACTION |
|---|-------------------|
| DUPLICATION OF TOP HALF OF SCREEN<br>ON BOTTOM HALF                         | REPLACE 8085A/CPU |
| SCREEN FLICKERING UNTIL HAVING TO<br>DO A CNTRL RESET<br>TO RESET THE LOGIC | REPLACE 8085A/CPU |
| NO VIDEO/HIGH PITCHED SOUND   | REPLACE 8085A/CPU |

### II.

One should also visually inspect the 220 ufd/35v electrolytic capacitor located on the flyback transformer for leakage and functionally check for an open condition.

### III.

These symptoms have been common on at least seven 3102's that have failed in the field with old and new 3102 main logic boards. The 8085A CPU's in these units were all Intel 8085A CPU's with a 76 date on them.

Note: This tech tip does not say that other faulty parts in the logic cannot cause similar symptoms. They are only an account of one field technician's experience with 3102's.

Thanks Barry. Keep the tips coming.

## ANOTHER L.A. GROUP?

Los Angeles is a big city, and can certainly support more than one users' group. So goes the thinking of Nick Pavlovic, M.I.S. Director at Woodbury University. He wants to start a new group serving people living in Los Angeles, Pasadena, and Glendale. If interested, contact Nick at (213) 482-8491.

## DOUBLE DENSITY CONVERSION

Clarence Laney of San Jose, California sent this note which could be very helpful to all you users of Shugart 800 Disk Drives:

"I recently updated my Cromemco Z-2 System to double density using the Cromemco 16FDC Disk Controller. I thought my experience in completing this update might be of interest to other Cromemco users who use the Shugart 800 Disk Drives.

When the 16FDC was first installed, I could not BOOT UP the CDOS. I looked at the RDOS 2.01 program and noticed that the SEEK IN PROGRESS was checked to see if it was ON. This line is only used by the Persci drives with a voice coil actuator. This line is pin 10 of the disk interface (— SEEK COMPLETE). It is up all the time and must be tied down. This is Input Port 04 D6, Page 33 in the 16FDC Manual.

The procedure for loading CDOS is:

System power ON

Hit RETURN several times to get: RDOS 2.01 on the console

Type: A:: CR

Type: b CR

CDOS should then boot up.

Typing A:: before booting up sets the seek speed to medium for the 800 Disk Drives and allows the bootstrap loader to load properly.

Continued on next page



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## bits & bytes Continued from page 33

The total disk space in double density is 508K. The Directory with 128 entries (the default value for double density) takes 4K. This leaves 504K working storage per disk.

The 16FDC will read single density disks that have been initialized with INIT 2.15 or higher. Disks that are to be copied to double density must be copied to properly initialized disks first using the 4FDC.

CDOS 2.36 is required for double density, and all disks should be labeled.

I am pleased with the operation of the system, and I never see a disk read error in double density even though I am using good quality disks that are only certified for single density.

I hope this information is helpful to others and makes their transition to double density even smoother."

Thank you, sir.

### NWACU ORGANIZED AND GROWING

The NorthWest Association of Cromemco Users, formed in the Seattle area, reports that organization and goals are pretty well set, and the group is up and running. It meets the last Monday of each month at Maverick Microsystems in Redmond. If you are interested in affiliating with what promises to be an active group, contact Jim Illman at (206) 932-8771, or call the folks at Maverick.

### BRITISH LIBRARY NEEDS HELP

Ian Winship, Applied Science Librarian at Newcastle upon Tyne Polytechnic sent the following note:

"We have acquired a Cromemco System 3 for our Library for use as a terminal to access remote data bases, to maintain bibliographic information files, for analysis of library management data, and so on. We would be grateful for any help we can get in developing our system but know of no library or information unit in the U.K. with a Cromemco. Do you know of any in the U.S.A. or elsewhere?"

If you know anyone with experience in this area, please have him or her contact IACU. We feel this is a valuable area for someone to develop, as more and more libraries will undoubtedly be converting to computers, and someone out there must have an interest in what could amount to a lifetime of computer consulting for libraries.

### OHIOAN LOOKING FOR LOCAL GROUP

Jeff Kettell in Columbus, Ohio is looking for other users in his area — either an existing group, or perhaps the nucleus of a new group. Jeff can be reached at his office at (614) 272-0202.

### PROBLEM SOLVED

Joseph Stoffel, of Aurora, Illinois sent the following:

"I purchased some software from MICA which advertises in the I/O News. The software does not work and they have not been helping me solve the problem. I am hoping that you may have ... some influence with getting MICA to either refund my \$100 or give me a program that works."

We presented Mr. Stoffel's letter to MICA, and they readily agreed to refund his money. In fact, the whole matter should have been settled before this issue is published.

Happy to have been able to help.



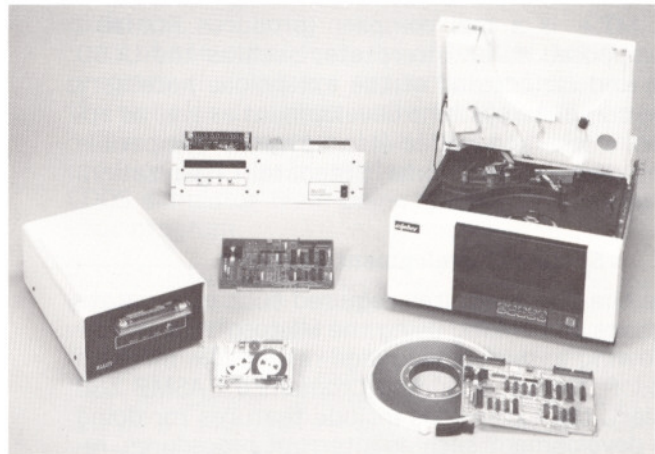
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Perhaps the greatest advantage in terms of convenience will accrue to those outside the U.S. who are desirous of joining the IACU, but find it a time consuming and expensive proposition to convert their natural currency to U.S. dollars, drawn on U.S. banks, a necessary requirement.

In addition, payments for advertising can be made with the popular credit cards, a benefit to small companies without established advertising budgets.

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# Pascal for CROMIX

By Jim Blum

The version of PASCAL from MT Microsystems called PASCAL MT+ is a real compiler (produces ROMable code as opposed to an interpreter such as the UCSD PASCAL) and includes all of the extensions necessary for doing complete systems development as well as applications work, and yet is also upwards compatible with the ISO (International Standard Organization) draft proposal.

## Systems Development Features

Beside the basic features required such as separate compilations and linking using the Microsoft linker format (allowing assembly language relocatable modules in Microsoft format including Cromemco's ASMB Z80 Assembler), the extensions include features for doing systems development such as interrupt procedures, redirection of I/O, 8080/8085 I/O support such as "in", "out", "rim", and "sim", optional Z80 optimization, a special "inline" feature for executing assembly language instructions directly and generation of tables at compile time, complete pointer capability including pointing to procedures (eg, pointing to a procedure containing a table generated by using "inline"). Also included is a debugger, a disassembler for producing interleaved PASCAL statements with the generated machine instructions in 8080 mnemonic form. Complete ROMable code can be produced and run on target hardware using redirected I/O and/or rewriting portions of the run-time package by modifying the source code included with the package. Bit operations such as shift, logical and/or, test/set/clear bits, and hi/lo byte are also supported. Additional data types are included such as "byte", "word", "dynamic strings" with many string operations such as concatenate, delete, position, etc.

## Applications Development

For applications work, BCD reals are supported, plus optional compiler toggles for restricting the use of system oriented extensions for portability. Complete type and range checking may be turned on or off for debugging and compatibility.

## Program Chaining

Another nice feature is program chaining allowing one program to call another, and provides for sharing data between the programs by locating the data in an area which doesn't get overlayed when chaining to the next program.

## Operating Systems

PASCAL MT+ runs under CP/M and CDOS. However, random I/O requires CP/M version 2 for the random I/O calls to work. The compiler requires at least a 52K standard CP/M system. The memory requirement for the compiler limits the size of the program you can compile, but you can eliminate sets of built-in pro-

cedure and function names which you don't need, freeing up some space, or you can break up your program into smaller modules.

## CROMIX

PASCAL MT+ also runs under Cromemco's CROMIX operating system using the CDOS simulator which gives you sufficient memory for compiling good sized programs since only approximately 4 to 5K is used for the simulator and the CROMIX OS interface. This gives you approximately 60K of available memory.

## CROMIX RUNTIME PACKAGE

Since the CROMIX environment is extremely nice for program development, provides much more available user memory space, and the disk I/O is much faster than CDOS, and PASCAL MT+ is such a nice and complete language, I decided I could get even more memory space available, faster I/O, and full use of CROMIX features by modifying the runtime package to make direct CROMIX system calls instead of CP/M (CDOS) calls. This eliminates the CDOS simulator middleman providing 3 to 4K more of memory for programs for a total of 62 to 63K of memory (1 to 2K is required for the CROMIX OS interface).

## Faster Disk I/O

CROMIX uses 512 byte blocks and sector sizes, speeding up I/O, and providing more disk space since less sector headers are required. File buffering is automatically handled by CROMIX, so I eliminated it from the PASCAL runtime package. This eliminated the extra unnecessary buffering step, removed the 128 byte CP/M record restriction, and reduced the runtime memory requirements.

## Full CROMIX Path (directory and file) Name Support

Full CROMIX path names (See Cromix Manual) for file and device I/O are supported using the CROMIX systems calls. Path names may be up to 128 characters long (which is the limit in CROMIX).

## File I/O

All file I/O in PASCAL is supported under the CROMIX runtime package and operate identically to the description in the PASCAL MT+ Manual with the exception of Random I/O (see Random I/O section), and there are some differences in error returns (see below). Unlike the CP/M (CDOS) version, all successful I/O operations including RESET and REWRITE return a zero for successful operation, and all error returns are non-zero and correspond to CROMIX error numbers — see CROMIX Manual for a list of the error numbers and corresponding meanings. The standard IORESULT function is always used to test the result of the I/O operation.

The CP/M device mnemonics, CON:, TRM:, KBD:, and



LST: were left in for compatibility with CP/M, but use CROMIX open calls to open the respective devices. However, the mnemonics MUST be all capitalized to be recognized. CON:, TRM:, and KBD: all use the CROMIX standard input and output, which allows the use of re-directed input and output when running the programs. TRM: and KBD: mean the same thing and turn off console echo. LST: uses /dev/prt. Of course any device may be opened using a path name of /dev/devicename as long as you are allowed to open the device such as being superuser.

RESET and REWRITE both open the file for read and write to allow random read/write operations (except if REWRITE is used to open the printer in which case it is opened write only). REWRITE empties the file first.

### Random File I/O

Random I/O is supported under CROMIX via the SEEKREAD and SEEKWRITE built-in procedures in PASCAL MT+ (See PASCAL MT+ manual for call format) to read and write specified PASCAL defined records by logical record number. IE, the size of your defined record in your PASCAL program is used as the size of the record to read or write, and the record number corresponds to the logical record number in the file. Unlike the CP/M version, the record does not correspond to 128 byte records. CROMIX random I/O is byte oriented — all blocking is done internally in the operating system making it transparent to the user. 32 bits (two 16-bit register pairs) are used as a byte pointer in the file, so that any byte in a file (which may be as large as the file system permits) may be accessed. However, you normally don't have to calculate which byte number the record begins on, as that is done for you in the runtime package. However, since the record number you specify in your program is limited to 16 bits since SEEKREAD and SEEKWRITE use an integer for the record number, the highest record number you can access is 65535 (the first record number in the file is record number zero). For files containing more than 65536 records, a direct call to CROMIX may be used (see @JSYS function) by computing the record size using the built-in SIZEOF function, and multiplying the size by the record number and executing the SETPOS JSYS call followed by a sequential read or write JSYS call (See CROMIX manual for details).

Random and sequential files are compatible under the CROMIX version unlike the CP/M version (See PASCAL MT+ manual for an explanation of CP/M random I/O). This does mean that any random files created under CP/M will have to be converted to be compatible with the CROMIX random I/O files, but once converted, will make access much easier, since random and sequential access operations can be mixed under CROMIX.

### CROMIX system call function — @JSYS

Direct CROMIX system calls may be made using the function @JSYS. It is defined as follows:

FUNCTION @JSYS(FUNC,A,B,C,D,E : BYTE; HL : WORD);  
INTEGER;

The calling parameters are as follows:

INPUTS:

FUNC = CROMIX System Call Number

A,B,C,D,E,HL = Required Z80 Register contents

### RETURNS:

ZERO = Successful Operation

NON-ZERO = CROMIX Error Number

In addition, the contents of registers after the call are accessible via the following variable names:

@A,@B,@C,@D,@E : BYTE; @HL : WORD;

The @JSYS function along with any of the register variables used must be declared external in your program.

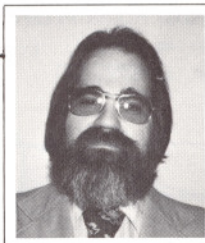
All of the other features of PASCAL MT+ including program chaining are supported and operate exactly the same as described in the PASCAL MT+ manual.

The linker program, LINKMT, has been changed to produce .BIN files instead of .COM files to prevent the CDOS simulator from being loaded upon execution of your program.

The CROMIX/PASCAL runtime package is available from the author's company, COMAGRAPH, for \$95.00 plus \$5.00 for the diskette, and mailing charges. Included is the source for the CROMIX runtime package, the new LINKMT program, and the PASLIB.ERL CROMIX relocatable runtime library. If interested, contact the author at: COMAGRAPH, 768 Inwood Drive, Campbell, CA 95008. His phone is: (408) 374-9000. He will send you a license agreement which must be executed. Then, mail the license agreement along with your check in the amount of \$100.00 (\$95.00 if you supply your own diskette) to COMAGRAPH. Be certain to specify in what format (CDOS, CROMIX, single-or-double-density, 5 1/4" or 8") you would like your diskette.

### About the Author

Jim Blum is an Engineering Development Systems Manager at a division of TRW. He has also started his own company called COMAGRAPH, an acronym for Computer Automated Graphics and Text Processing. He has been in the computer field for over 13 years mainly in the area of systems software. He presented a paper at the 1980 Computer Faire in San Francisco entitled "ANIMAL — An Animation Language used in Creating Animated Scenes in Color on a Personal Computer" which was an experiment in the area of computer animation to see what could be accomplished on an inexpensive computer system using PASCAL as the implementation language. Since the writing of his paper his work has evolved more into the complete spectrum of computer generated visual systems, all the way from documentation preparation with total graphics and hard copy capability, to live-action presentations using video tape to store the computer generated images, mixed with optional video camera input and audio dubbing. At COMAGRAPH he is writing software for reliable and inexpensive OEM computer and video hardware to produce a complete family of products for document processing with complete graphics capability, broadcast and non-broadcast video applications, and computer generated visual systems for presentations and instructional courses using video tape, film, etc. He is currently developing a composition software package called COMANDER I on a Cromemco System III.





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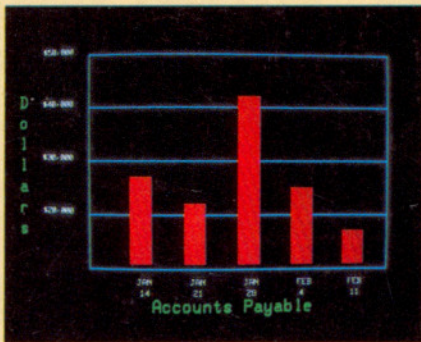
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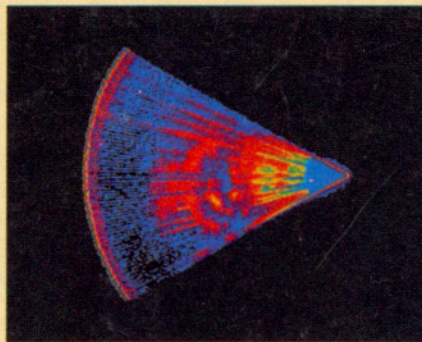
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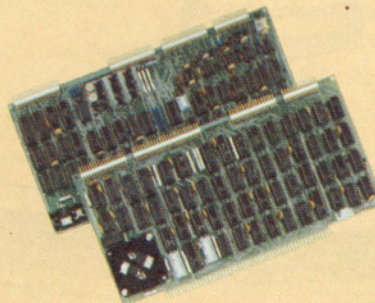
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